

# Chemical Weekly

VOL. XXXVI

OCTOBER 2, 1990

NO. 4

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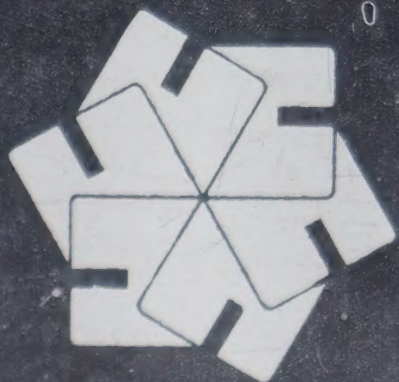
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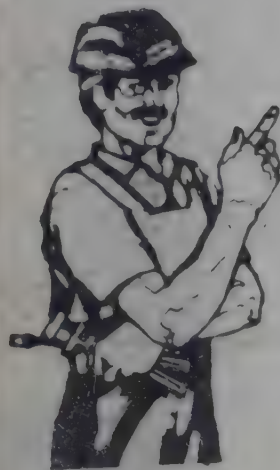
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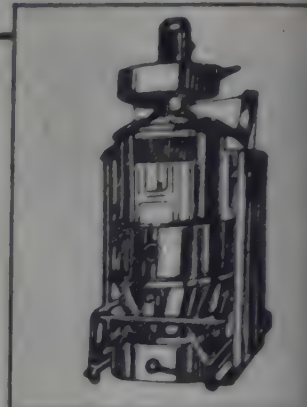
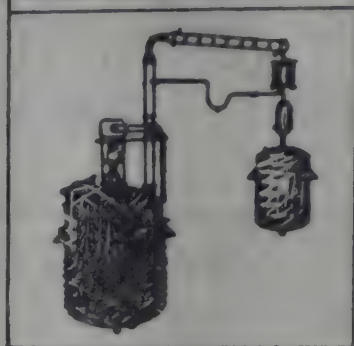
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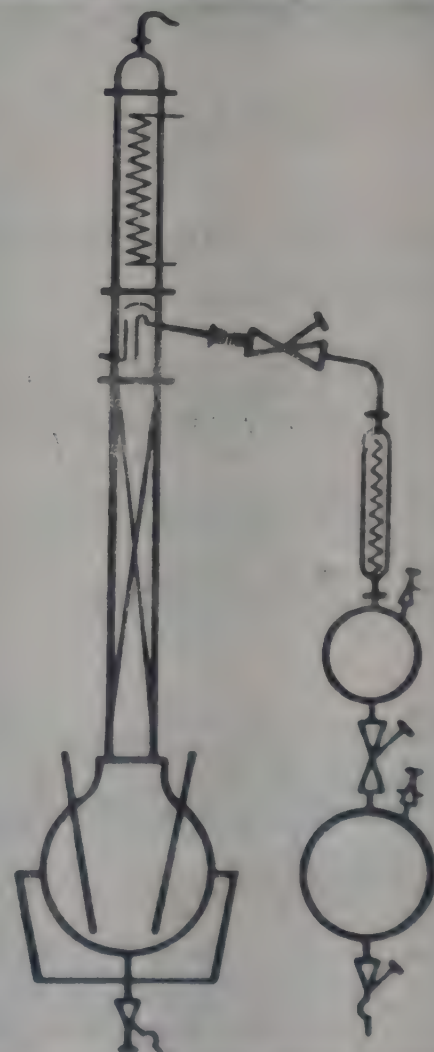
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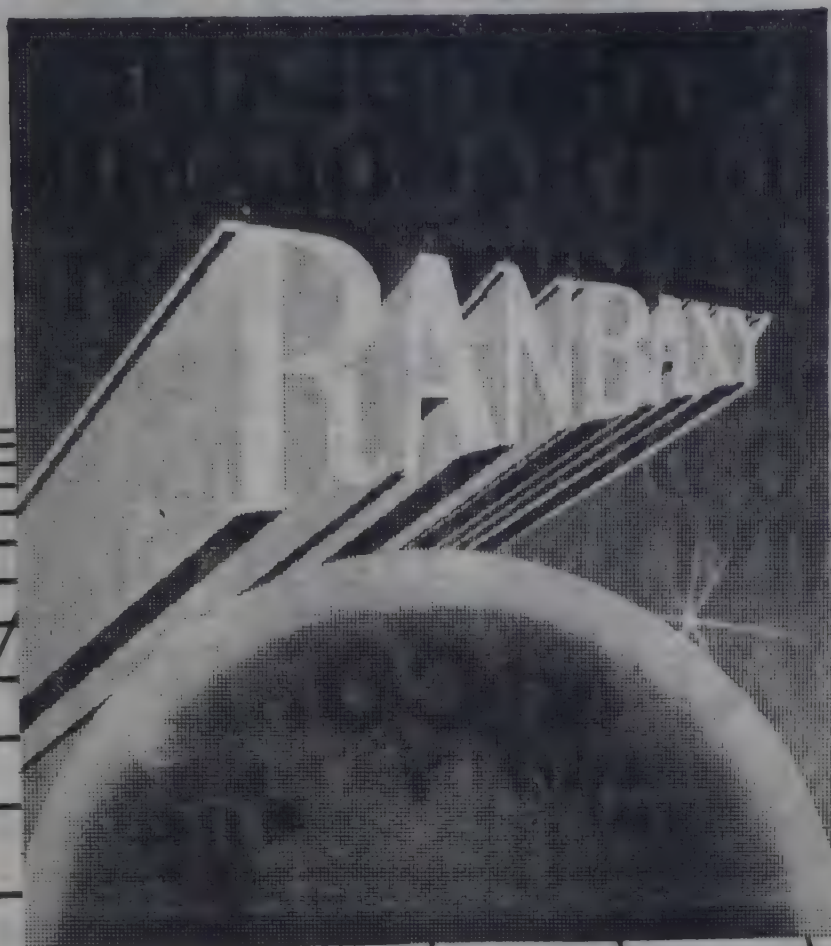
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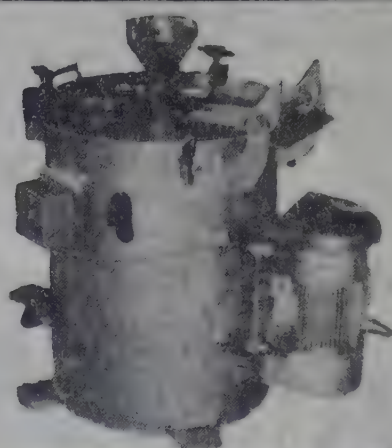
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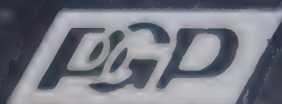
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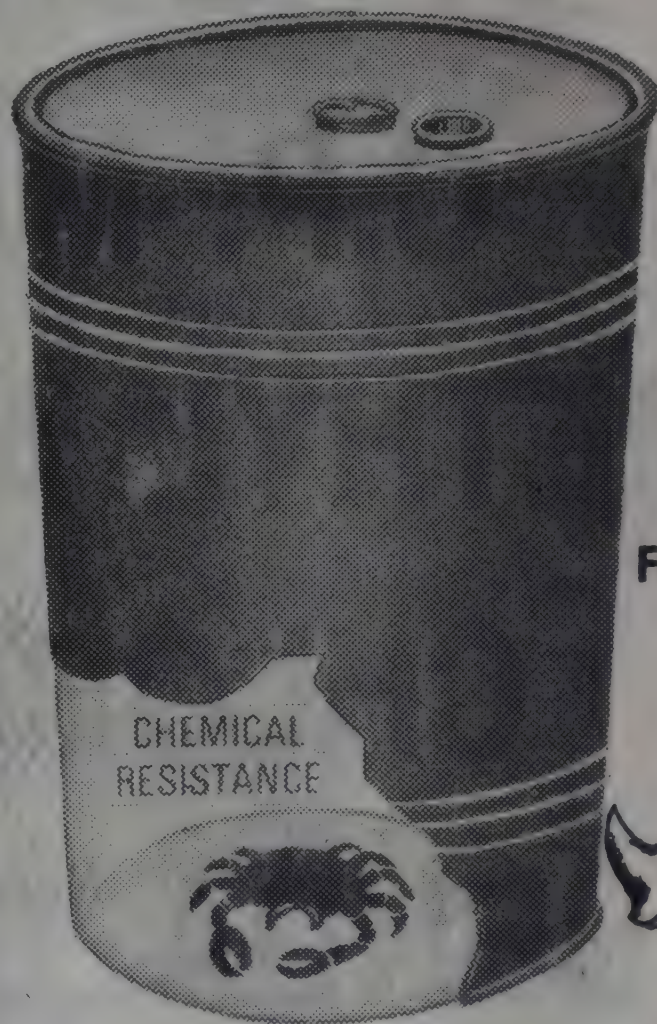
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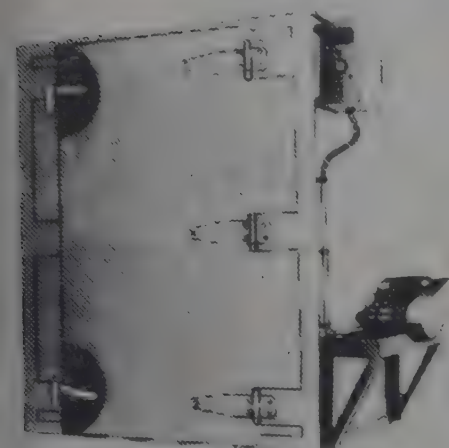
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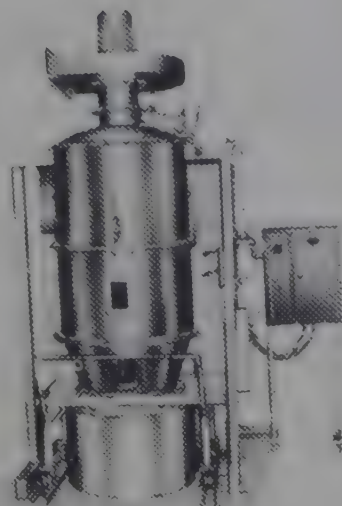
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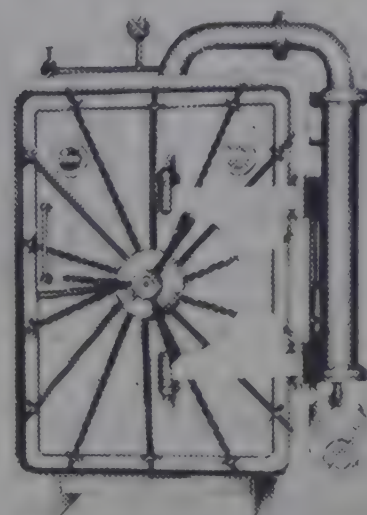
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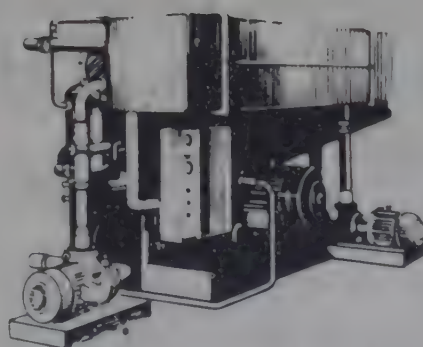
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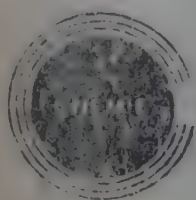
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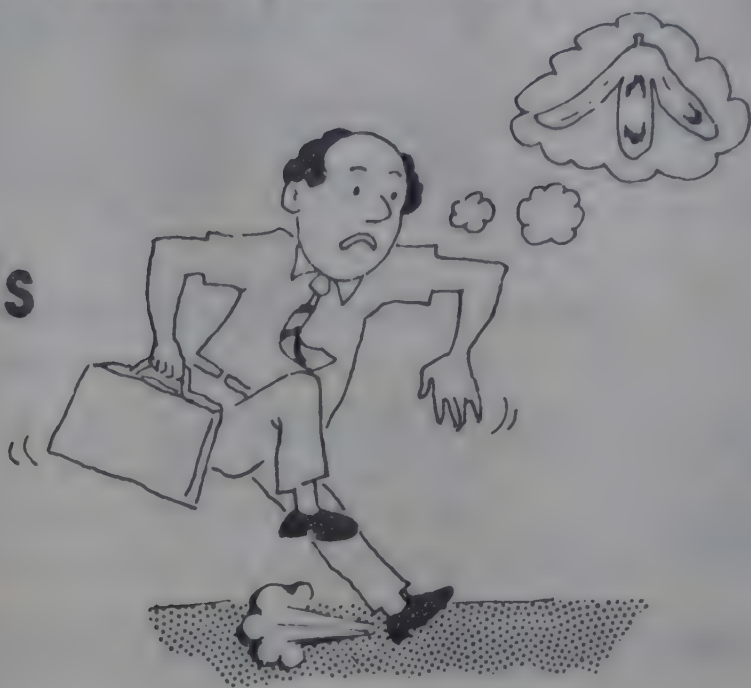
178, Sant Tukaram Road, 1st Floor, BOMBAY 400 009.

Phone: 8512053/8517313/8728929

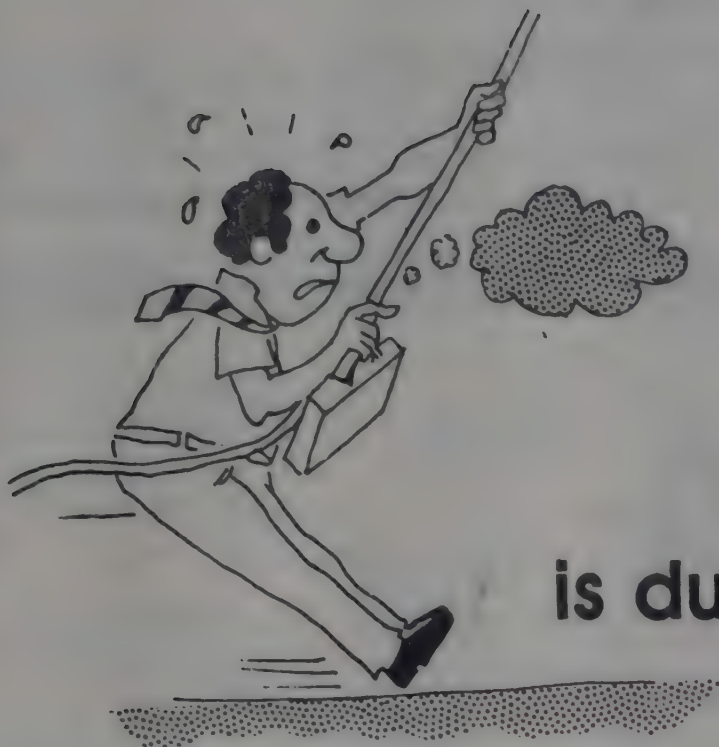
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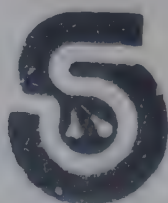
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# CHEMICAL WEEKLY

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## Future sources of supply of oils and fats for human consumption

From palm oil to soya beans, the world vegetable oil market is sliding gently downhill. Only a major drought surprise intervention by one of the big buyers can lift the sales of products used worldwide for cooking.

Vegetable oils have the lion's share of the \$35-billion-a-year market in animal, vegetable and marine fats and oils. It is a complex market in which groundnuts from India compete with soya from Brazil and cotton seed from China.

It is a market in which production is shifting to efficient Third World growers, such as Malaysia and Brazil. And it is a market in which demand is increasing in the Third World and falling in diet-conscious industrialised countries.

About one-third of the vegetable oils enter the world trade, the rest being used in the country of origin. The biggest importers of soya oil, the vegetable market leader, are Argentina, Brazil and the United States.

But Malaysia is a huge exporter of palm oil, more than 1 million tonnes in 1989, mainly to the Netherlands and the United States. The European Community is the biggest importer of rape seed oil and Senegal of groundnuts and their products.

Vegetable oils have different characteristics and prices but to a large extent are interchangeable. In Colombia, for example, Unilever has successfully established palm oil plantations to meet local demand.

Vegetable oil of some kind can be grown and produced almost everywhere in the world. The Soviet Union is the world's biggest producer of sunflower seed, India of sesame and castor seed as well as groundnuts and Canada produces rapeseed oil. But the trend is for production to switch from industrialised countries to the South. Palm oil is exclusively a Third World commodity, while half or more of all soya, cotton seed and rape seed is grown in developing countries, as is 90% of groundnuts. The industrialised countries are the principal growers only of olives and sunflower seeds.

Different plants produce different percentages of oil. Copra, for example, yields up to 64% while soya gives 18%. Soya, however, accounts for about 30% of all vegetable oil output. Hard oils -- coconut and palm -- account for a further 25%.

Analysts note some likely shifts in the market this year. The Soviet Union, despite its own substantial production of cotton seed, rape and soya, has long been a significant importer. This year, however, Moscow's foreign currency shortages are likely to inhibit any buying spree.

China too is experiencing foreign exchange difficulties. India, on the other hand, is expected to buy more from abroad to supplement its own substantial vegetable oil output.

Analysts say that in the longer term, prospects for efficient vegetable oil producers are good as Third World consumption rises. In the short term, competition for the bewildering variety of oils used in the kitchen will be fierce.

In 1987 the world production of oils and fats was about 72 million tonnes, and was mainly of vegetable origin -- e.g. soyabean -- but some from land animals (lard and tallow) and some from fish. World production has increased in recent years and is expected to go on increasing to meet demand. This demand is determined mainly by income -- consumption rises with income. While in the West we are expected to worry about saturated to unsaturated fat ratios, much of the world requires extra calories from any source. Developing ways of increasing oil in terms of quality and quantity is the challenge facing the oil technologists.

Over 40 years (1958-62 to 1998-2002) the world production of oils and fats is expected to increase from 29 to 105 million tonnes. This growth is based almost entirely on four oils -- soyabean, palm, sunflower and rape seed. The remaining sources provide only 41% of the total at the end of this century, and all of them will lose market share.

It is not surprising to see rape seed oil as one of the growth leaders. Its bright yellow flowers have become a significant

part of the countryside in northern European and Canada in the early summer months. This reflects, in part, the desire of the European Community (EC) to be more self-sufficient in its supply of vegetable oils. The EC remains, however, a considerable net importer of such materials and this position is not likely to change.

With this in mind it is worth noting the cost of production of 1 tonne of these oils in countries where they are most commonly grown -- palm oil in Malaysia (\$215), soybean oil in US (\$315), and rape seed oil in Europe (\$750). These figures are estimates for 1987. There is clearly a high price to be paid to have an indigenous supply of oils and fats in Europe.

About 80% of the oils and fats now produced is eaten and another 6% of poorer grade material is used in animal feed. The remaining 14% is used by the oleochemical industry, mainly to make surface active materials such as traditional soaps.

The demand for oils and fats depends on the population and rises with per capita income. Many in the developed world would be wise to reduce dietary intake of fat and are also advised to watch the balance between saturated, mono-unsaturated, and polyunsaturated acids of various types. Saturated fat is reported to be a contributory factor to heart disease through progressive blocking of the arteries (arterosclerosis). Too much fat in the diet can lead to obesity, which increases the risk of high blood pressure and maturity-onset diabetes. But a high proportion of the world's population is under-nourished and has a basic need for calories of which oils and fats are the most convenient source. The refinements of saturated and unsaturated fats are of little concern to such people. If society could solve the problems -- economic, political, moral -- of getting oils and fats from the producer countries with an excess to the impoverished countries, then the demand would probably exceed the increased production forecast.

From the study of the population changes from 1955 and forecast changes to 2005 it is clear that the greatest population growth has been in the less developed regions. Of the increase of 3.9 billion in the 50 years between 1955 and 2005 the more developed regions will increase by 0.4 billion (44%) and the less developed regions by 3.5 billion (184%). While Japan, the US and the EC countries are expected to increase by 40-50% over the 50 year period, China and India will increase by 94% and 136% respectively. India and China will each have a population in excess of one billion and will go together make up 43% of the world's population in 2005. These additional people need to be fed.

During the five year period 1983-87 the world average consumption of fat was 13.9 kg. per person. For the US this figure is 38.5 kg., for the EC countries 36.2 kg., for China 6.5 kg., and for India 7.0 kg. It would require a lot more oil and fat to raise the figures for China and India with their enormous populations to the current average.

Real disposable income is the most important factor determining consumption. Japan and Brazil now have above average consumption. The Japanese intake has increased fourfold but is still only half the EC figure, while China has increased its intake threefold in the past 10 years. The slowest movement in the past 30 years has been in India. It has also been argued that the demand for oils and fats in the developed world is not likely to decrease.

**Oils of controlled composition.** The natural oils and fats produced by nature and available in significant quantities are not always ideal for their end use in the food industry and several ways of modifying their properties have been developed. These include the blending of different oils, fractionation, partial hydrogenation, and interesterification to rearrange the fatty acids among the glycerol units. Of these fractionation -- which involves a crystallisation process to separate higher melting (more saturated) glycerides from lower melting (more unsaturated) glycerides -- is a popular procedure. The separated fractions (a 'stearin' and an 'olein') may have different uses from the original oil from which they are derived. Fractionation processes are continually being improved to give more carefully defined fractions. This has been applied extensively to palm oil in Malaysia and is being investigated for butter fat in New Zealand.

Developments in large scale chromatography are also being exploited to produce 'pure lipids' from natural sources. Such 'pure lipids' include triacylglycerols available on the 100 kg scale and individual phospholipid classes (e.g. -- egg yolk phosphatidylcholine) available on the 5-10 kg. scale.

**Health-promoting oils.** The public demand for healthy and 'natural' foods has affected the oil and fat industry. A variety of dietary and health claims have been made, particularly in respect of oils rich in gamma-linolenic acid (6,9,12-octadecatrienoic acid) and of fish oils rich in EPA (5,8,11,14,17-(e)icosapentaenoic acid) and DHA (4,7,10,13,16,19-decaxhexaenoic acid). Oils containing these materials are thought to lower cholesterol levels, and are sold, usually in capsule form, in health stores and pharmacies. The metabolism of polyene acids (acids containing 18-22 carbon atoms and at least two double bonds) in the body is slowly coming to light. The competition for enzymes between the different acids of this type leading to the differential production of metabolites is known to be important, if not yet fully understood. Our incomplete scientific and medical understanding has not stopped the development of a market for these commodities. EPA and DHA are available as glycerides or as ethyl esters produced originally from fish oils. Gamma-Linolenic acid is available in evening primrose seed oil (8-14%), borage seed oil (21-25%), black-currant seed oil (15-19%), and in a microbiological product (oil of javanicus 15-18%) pioneered in the U.K. Some of the larger pharmaceutical companies are now showing an interest in these materials.

— T.P.S. RAJAN

(Source: *Chemistry in Britain*, June 1990, article by Professor Frank D. Gunstone, an honorary research professor in the Department of Chemistry, University of St. Andrews, Fife)

# CHEMARENA

S.L. VENKITESWARAN

## Synthetic Fibres at a mature level

*CE News* reports that ten years have made little change in the total production and capacity of non-cellulosic fibres in USA. There have been mergers and cutbacks to maintain viability but now there are hopes of better days ahead due to a modest swing in newer markets for geotextiles and non-wovens. The fibre business is cyclical to the extent of change in fashions and the import into USA of dress material or readymade garments. The synthetic fibre industry is also buffeted by the price levels of intermediates at several stages -- basic aromatics from naphtha, fibre intermediate from the aromatics (principally benzene and paraxylene) and the polymer and spinning and finishing operations.

US reports production of 4 million tonnes of synthetic fibres both in 1988 and 1989 and this is the same as a decade earlier. During the decade non-cellulosic fibres dropped to 3 million tonnes from a capacity of 4.5 million tonnes. The biggest shifts in ownership was Hoechst takeover of American Celanese and BASF takeover of American Enka. DuPont continues to dominate US scene. Microdenier fibres have made their advent but perhaps only for specialities. One casualty of the eighties is acrylic fibre, production of which fell by over 30%. Of the producers only Monsanto is holding fast to acrylics in USA with improved fibres for hosiery, career apparel and uniforms and for carpet.

A review in the *ECN* of 26th March also presents a similar picture for Europe with synthetics well towards the end of the "S-curve". Polyester dominates everywhere except for carpets where nylon prevails but most of the overall fibre

production is below GNP growth rate. There are heavy growth prospects in the Far East with production of the basic intermediates taken up in a big way. In 1980 world polyester production was 5.1 million tonnes out of a total of 10.5 of all synthetics after a spectacular growth rate of 12% a year in the Seventies. Now after the Eighties polyesters are 8.6 million tonnes after a 5.5% growth rate largely through production in new areas. Added to the fibres, polyester has made an impact in packaging with PET at a million tonnes a year now. World paraxylene production is estimated at 6.9 million tonnes while PTA has taken a share of two-thirds of the market as against one-third for DMT. World production area-wise in 1980, 1989 and forecast for 1999 are as under:

% Share in	1980	1989	1999
US	34%	19%	13%
W. Europe	15%	11%	7%
Japan	12%	8%	5%
Far East	22%	45%	60%
Rest of world	17%	17%	15%

Prices and margins seem to have suffered in recent years.

Demand of synthetics are expected at 14-15 million tonnes by 1999 with additional 3.5 million tonnes of PET resins for packaging. Paraxylene demand should touch 12.5 million tonnes and any shift to other raw materials like toluene is unlikely. PTA will dominate the 15 million tonnes of combined PTA/DMT market and MEG usage for polyester is expected at 7 million tonnes.

## The Middle-East conflict and its toll

Five to six weeks after Iraq moved into Kuwait there is a lot of uncertainty for the future. The price of crude oil seems to rule at \$ 26 per barrel and if this continues the impact may not be so bad for the Western and Far East countries. India's anxiety is for securing the big gap in imports left by cut-off in supplies from Iraq/Kuwait and by the swap of Iraqi crude for USSR supplies at the other end. India's import bill on oil (supplies will shift to other sources) is expected to go up to Rs. 10,000 crores unless some drastic cuts on consumption can be imposed. In the international market, prices of feedstocks for petrochemicals are rising and the price of naph-

tha has shot by nearly \$ 100 per tonne to the level of \$ 270. The impact down the line will soon take effect. Paraxylene prices have gone up sharply and immediately the price of India's PTA/DMT. Naphtha for the industrial units in India have been cut 10% which is perhaps uncalled for. It is too early to visualise the supply and price situation for polymers of which nearly 2 to 2.5 lakh tonnes are being imported to meet deficits. May be the early start-up of MGCC cracker may cut this down from next year.

One of the chemicals not linked to naphtha but to natural

gas is methanol and there is a tightening of markets and prices as demand has caught up with capacity, mainly due to large increases in MTBE. New large plants have been slow and Saudi's plant of half a million tonnes may be expected shortly. Overall capacity rise of 2.7 million tonnes is expected over the next 3 years but prices will be up. As a consequence, price of acetic acid is expected also to go up. European ethylene price is at DM 870/tonne.

An intriguing situation has arisen in the huge investments

of Kuwait in major oil and chemical projects world wide -- 20% in Hoechst, 10% in British Petroleum, 40% in Spain's Ercros besides a host of others. Of course these are out of Iraq's reach now. Iraq is also facing serious trouble for his second petrochemical complex to be built at an estimated cost of \$ 2.5 billion. Based on over 400,000 tonnes of ethylene and various polymers, MEG, MTBE, synthetic rubber etc. are included and will be indefinitely delayed.

All-in-all the price rise of petrochemicals is inevitable

## Degradable plastics and solid wastes

US production of plastics is in the region of 30 million tonnes a year and a third of this goes into short-term disposable packaging uses. Such discarded plastics are highly visible components of municipal refuse -- 7% by weight but 18% by volume and expected to go up to 10% by weight. Even after years of efforts hardly 1% of plastics are being recycled. The emphasis on making plastics biodegradable has created more problems than solution. The plastics are sensitive to ultraviolet rays but often additives are used to counter such degradation. Now efforts are on to add photosensitive functional groups in the polymer to induce degradation. Starch can be blended and can be bacterially degraded but it takes a long time. Several legislative measures have been proposed in the different states but problems are unresolved as yet. Agricultural Commodity-based Plastics Development Act is one to encourage starch-based plastics. There is an international treaty MARPOL Annex which seeks to ban ocean dumping. The agro-oriented states are all for starch-based polymers as they can provide a market for corn. One estimate is that degradable plastics based on starch could grow rapidly to 850 million lbs by 1992, as against 298 million lbs of material (including photo-sensitive material) in 1988. Paper companies are also eyeing the market. But actually all these wastes go into landfills and the cities have so little left for such landfill disposal, even if the plastics components are degradable. The degradation also varies with environmental conditions and by-products may add to the problems.

EPA seems to emphasise that solid waste management should not be through landfills but through source reduction and recycling or incineration with energy recovery. About 80% of solid wastes is landfilled, about 10% incinerated and 10% recycled as per EPA. The municipal wastes in USA are

paper and board 36%, yard waste 20%, food 19%, metal 9%, glass 8% and plastics 7%. Certainly a very mixed composition to handle. Time factor for degradation is a very serious factor and enhancing biodegradability will have little impact in sanitary landfills. The environmentalist group -- Greenpeace -- calls the biodegradable plastics as a hoax on the public. But certain points are clear -- degradable plastics will not extend the life of landfills; potential risks to health from release of toxics; threat to wild-life; increased use of plastics and possible pollution from such production.

Another problem is how far the promotion of recycling is compatible with the efforts at degradability. Entire thermoplastic component of wastes is technically recyclable. But there is a large variety of materials and mixed streams may have to be processed. Recycling has to be preferably limited to items collected independently as a part of total solid waste. One of the promoters of biodegradable plastics is Archer, Daniels & Midland, the giant in corn processing and hence of starch derived materials. It is too early to forecast how far they will be able to advance. Warner-Lambert have also introduced a starch-based polymer called Novalon which is claimed to be somewhat like polystyrene. It is said to disintegrate rapidly in water but all this is experimental. Montedison have also taken up starch resins with 60% starch and starch derivatives. ICI have their poly(hydroxy butyrate -- hydroxyvalerate) resin -- PHBV -- now introduced and derived from bacterial strain of *Alcaligenes eutrophus*.

All these are new approaches. India is unique in the maximum recovery and recycling of plastics and the large organisation of collectors and processors will take care of our plastic wastes at least till the end of Nineties.

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## No excise on goods made for export

In a major procedural simplification, the Government has notified that no excise duty will be payable on goods manufactured for export purposes. Hitherto, the manufacturer had to pay excise before the goods left the place of manufacture, though it was later reimbursed, resulting in a delay in payments to the manufacturers. However, the manufacturers would have to satisfy the departments concerned through a set of stringent conditions laid down by the Government in this regard. First of all, the manufacturer of such goods would be required to have an advance intermediate licence or should have applied for the same and should possess an acknowledgement in this regard, for the supply of such goods to a manufacturer holding a duty exemption entitlement certificate and also an advance licence under the duty exemption scheme.

The intermediate goods also have to be supplied against an advance release order to an ultimate exporter for use in the manufacture of resultant articles to be manufactured from these goods. However, the quantity of these goods removed from the places of manufacture without the payment of excise duty should not exceed the duty free entitlement as indicated in the respective duty free entitlement certificates issued to an ultimate exporter. The notification said that it is important that the goods are utilised by the ultimate exporter for the manufacture of resultant articles to be exported or for use as replenishment of duty paid excisable goods of identical specifications and technical characteristics, which have been used in the manufacture of the resultant articles already exported in discharge of export obligations under a duty exemption entitlement certificate.

However, these intermediate goods may also be utilised for further production in the factory of the ultimate exporter or may be disposed of in a manner specified by the assistant collector of central excise, under which the

exporter and his factory is registered giving all details about the ground plan of the factory, detailed description of each of the intermediate goods and the resultant articles and such other particulars as specified by the said collector.

It was specified that the ultimate exporter would have to enter into a bond with the assistant collector concerned with a specified amount of security undertaking to pay an amount equivalent to the excise duty leviable on the intermediate goods. Moreover, it was also specified that every time the ultimate exporter required the intermediate goods, he would have to apply separately to the assistant collector attached to his concern. He would also have to make the necessary arrangements for facilitating the movement of samples and subjecting them to tests as directed by the assistant collector of excise.

However, any byproduct arising out of the process of manufacture undertaken by the exporter on the intermediate goods obtained would have to be either cleared on payment of duty or be allowed to be used again for the manufacture of resultant articles or be destroyed under the supervision of an officer of the central excise according to proper procedures laid down in this regard provided the goods are found unfit for use. The notification pointed out that the exporter would have to export the products within a period specified in the duty exemption entitlement certificate or within the extended period as has been permitted by the licensing authority concerned. The exports of the products made out of the intermediate goods like nylon fibre and yarn, nylon fabrics, polyester yarn, fibre and fabrics, stainless steel sheets and strips, magnetic tapes, precious metals and metals clad with other metals would be made only through the sea ports at Kandla, Bombay, Nhava Sheva, Cochin, Madras, Vishakapatnam and Calcutta. They could also be sent through the airports at Bombay, Calcutta, Delhi, Madras and Bangalore or any of the

container depots at Delhi & Bangalore.

### TECHSOURCE '90

The Industrial and Technical Consultancy Organisation of Tamil Nadu (ITCOT) Ltd. in association with the Entrepreneurship Development Cell, College of Engineering, Anna University, Madras and Dept. of Industries & Commerce, Government of Tamil Nadu is holding a National Technology Fair — Techsource '90 — at Madras from Oct. 25 to Oct. 28 1990. The Fair is sponsored by Indian Bank, Madras. There will be a major theme seminar TECH SOURCE 90 organised in collaboration with the National Research Development Corporation (NRDC), Delhi, on sources of technology during October 25th & 26th, addressed by invited faculty from all over India.

The Tamilnadu Industrial Investment Corporation Ltd. (TIIC) is sponsoring this seminar. Admission to this seminar which will be separately announced, will be on delegate fee payment. Another one day delegate seminar on 27th December on export of technology from India is also planned, with several national organisations participating. For further details contact: Mr. V. Sridharan, Senior Consultant, ITCOT Ltd., 50 A, Greames Road, Madras-6. Phones: 470324/474365. Grams: 'TANCONSULT'. Telex: 041-7736.

### DRUG INDUSTRY UP IN ARMS

Drug industry and trade are reviving the idea of going for a two-day bandh in the face of Government reluctance to ease price controls. Talks have started informally and a strategy will be concretised after a meeting with Mr. M.S. Gurupadaswamy, Union Minister for Petroleum and Chemicals, when he comes to Bombay shortly. By bringing a large number of combination drugs under price control, the Government is giving wrong signals and is not keeping its word on having consultations with the industry and trade.

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## G.M. Brahmbhatt passes away

We regret to announce the sudden demise of Shri Girish Brahmbhatt, Managing Director of Dura-Tex Laboratories, on 15th September 1990.

'Girishbhai', as he was popularly known was attending the company's all India sales conference at Chiplun, near Bombay, when he had a sudden heart attack and passed away.

Born in 1943, he had his education in Bombay, earning a B.Sc., degree. The family business called him at an early age and he joined Duratex in 1964. He was carefully groomed up under the watchful eyes of his father The Late Shri Muljibhai S. Brahmbhatt.

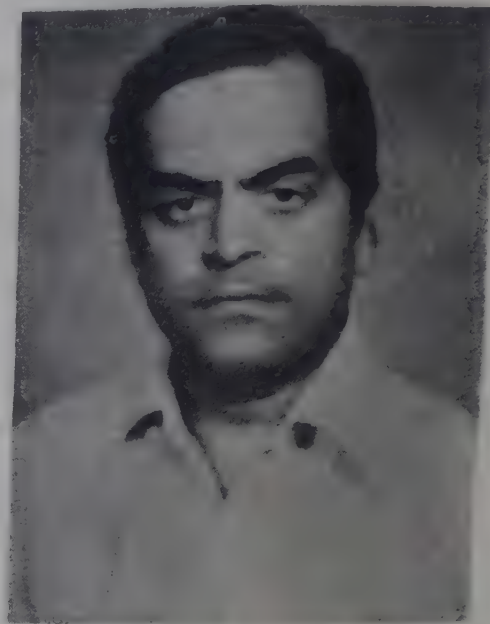
His early years were spent in the marketing sphere and his enthusiasm and energy made a success of his campaign of marketing Forcylor in small packs directly to the consumer. In the promotion of this product, he employed sophisticated methods using not only the usual media of newspapers and technical journals but also radio and cinema advertising. His imaginative use of these media helped to promote the image of Forcylor as the housewife's insurance against cloth-decay.

Alive to the importance of keeping one step ahead of others, he established a very good R & D base for Duratex, which in turn made it possible for Duratex to bring out a succession of sophisticated products. Girishbhai was in constant touch with the best technical brains in the wet processing field and this has made Duratex a pioneer in the promotion of their products to the elite in the industry.

Girishbhai had taken the unusual step of taking technology to the craft centres in the different parts of the country. He had arranged "get-togethers" where acknowledged experts from academic institutions and consultancy organisations had face-to-face discussions with traditional craftsmen, contributing not a little to the improvement of process which till then had been operated only on the basis of knowledge handed down from generation to generation. A widely travelled man, Girish Brahmbhatt was one of those restless individuals who could never remain at one place for long. He moved from place to place with frightening alacrity forever searching for new ideas in production and marketing.

Exports caught his attention and he put his record in this field also. In spite of his extremely busy schedule and the

demands of the fast expanding business. Girish Brahmbhatt found time



for community activities, taking a very constructive part in the schemes for the betterment of the less fortunate amongst us. In fact during the last ten years, after establishing his business on firm foundations, Shri Girish Brahmbhatt devoted most of his attention to the social welfare activities. He established the **Satmarg Foundation Trust** — which has been recognised by the Government of Gujarat and has spent over lakhs of rupees on development schemes in villages, particularly in the fields of education and farming. A lot of villagers would be benefited. He was also felicitated with FICCI award for Rural Development in the year 1988-89.

### APAR TO MAKE NITRILE RUBBER

The Apar group has promoted a new company, called Gujarat Apar Polymers Ltd., to implement a Rs. 37-crore project to manufacture nitrile rubber, a synthetic rubber not made in the country. Goodyear of the United States, the world's largest rubber and tyre company, will supply the know-how for the project coming up near Ankleshwar in the Bharuch district of Gujarat. Civil construction is almost over, machinery

undergoing training at Goodyear's facilities at Houston, USA.

Apar Ltd. will own 40 per cent of the new company and will be responsible for marketing nitrile rubbers and lattices. Eleven per cent of the equity will be held by Gujarat Industrial Investment Corporation (GIIC). The remaining shares will be offered to institutions and the public later this year. Nitrile butadiene rubber (NBR) is a speciality synthetic rubber. There are only about 12 NBR plants worldwide. Five of them are operating on Goodyear technology.

capacity of 6,250 tonnes. The company plans to market 27 grades of NBR including lattices and PVC blends.

NBR consumption is estimated in the region of 6,000 tonnes a year. As the only rubber resistant to oil and gas, NBR has a wide range of applications in oil exploration, petroleum refining and oil consuming industries.

Another property — high heat resistance — has made NBR the choice rubber for some electronic and trans-

## Govt. not to ration petroleum products

The government recently reiterated that neither did it intend to introduce rationing of petroleum products nor hike their prices, though the Gulf situation was none too satisfactory.

At the same time it also advised people not to panic about the situation. Mr. M.S. Gurupadaswamy, Union minister for petroleum, told newsmen that the government nevertheless was concerned over the shooting price of oil in the world market after the recent flare up in West Asia.

It was a national problem and therefore the country as a whole had to be involved in meeting the difficulties. Asked if any contingency plan of action had been prepared by the government to meet the situation, he replied in the negative.

There was no need for such a panic action. But he urged everybody to avoid wastage and save every drop of oil. It is the patriotic duty of all Indians to save oil, he said.

There is no thinking on either rationing or increasing the price of oil as of now, the Union minister told a questioner. The minister answering a spate of questions said the aromatics project for Tamil Nadu is full of life.

He stated that linking the South with the national gas grid involved a hefty investment and in the absence of funds he could not commit himself.

The question of making best use of the gas, being wasted through flaring needed an equally large investment. If you arrange for money, we can commit he said.

Earlier, the minister told a seminar organised by the Central Institute of Plastic Engineering and Technology (CIPET) to commemorate the UNDP's 40th anniversary that the World Bank had agreed to give a loan of \$ 12 mil-

lion for modernising facilities at CIPET and institution centres in six other places. This will help in the development of the plastic industries.

Mr. Gurupadaswamy said social and economic transformation was not possible without innovative changes in human culture and development and CIPET was trying to do the same. He also pointed out that the present government was trying to encourage human resource development, a subject which was neglected until recently.

Referring to 'criticism' in some sections of the press on petroleum curbs, the minister said criticism should not be carried too far. Critics should not assume that the petroleum ministry is an ignoramus, he said.

Asked whether any more restrictions were being contemplated, Mr. Gurupadaswamy said 'we have to assess the sit-

uation and take appropriate measures. There are many constraints operating

## OIL PRICE CAN SHOOT TO \$ 60

War in West Asia could push oil prices to \$ 65 a barrel this year and next, the World Bank has said. It has also predicted that oil would cost \$ 30-40 a barrel over the next five years.

"If efforts to defuse the existing crisis fail and war breaks out, Iraqi, Kuwaiti and Saudi Oil fields could suffer long lasting damage, effectively removing up to 10 million barrels a day from the world market", according to a report of the Organisation's International Economics Department released recently.

"World Oil prices would rise to unprecedented levels in 1990 and 1991 and would remain at \$ 30-40 a barrel for another five years or so", the report said.

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## Basic price of crude oil may be raised

The administered basic price of crude oil may be raised by the government to help the two public sector oil producing companies — Oil & Natural Gas Commission and Oil India Limited step up production in view of the present oil crisis.

An exercise to this effect has been initiated by the oil cost review committee. Experts in the Union petroleum and chemicals ministry feel that the oil crisis is unlikely to blow over soon, even if Iraq withdraws from Kuwait. They favour a contingency plan to step up crude production and tap new sources. This is believed to have necessitated a review of the net domestic price of crude payable to oil companies. The net domestic price of crude has remained unchanged for nearly 10 years since it was fixed at Rs. 967.85 per tonne in 1981.

The sub-group on exploration and development during the Eighth Plan had already recommended an increase in crude oil prices. The oil cost review committee is examining the report before taking a final decision on the quantum of increase to be allowed in the basic price of crude oil. Official sources say that while the sub-group left it to the government to decide on the extent of increase in the basic price of crude oil, it pointed out that although this price has

not been raised since 1981, the gross price of crude oil, also administered by the government, has gone up over 100 per cent on account of cess and royalty.

"The share of the oil companies in the gross crude oil price has, in fact, gone down from 83 per cent in 1981 to only 46 per cent in 1989", the report added. The report by the sub-group further pointed out: "The investment required for implementing the programmes and projects in the Eighth Plan is of the order of Rs. 29,171 crore. The direct contribution to the exchequer during this period on account of payment of cess, royalty, sales tax, corporate tax, dividend and customs duty etc. would be of the order of Rs. 28,860 crore".

Thus, it makes the case for a higher administered basic price for crude strong enough for the review committee to take a positive decision. However, the recent developments in the Gulf region, resulting in domestic crude oil shortage and higher import bill, provide further justification for increasing the basic crude price for ONGC and OIL to prepare and implement a contingency plan to pump more oil from the existing fields, if possible, and tap new sources. The sources say that ONGC alone can produce an additional quantity of nearly two million tonnes of crude oil

from untapped fields in Bombay shore and Krishna and Cauvery shores, within 10 to 12 months development work is initiated immediately. One of the reasons for ONGC tapping these proven reserves is the high investment cost of exploitation.

The sources say that the breakeven price for east-coast development roughly works out Rs. 2,700 per tonne although for Bombay off-shore development it would be lower. It is felt that even at such a high price of Rs. 2,700 per tonne, or \$ 20.57 per barrel, the country stands to gain substantially since the highly fluctuating spot price in the global market is still higher.

The present basic price of crude allowed to the oil companies works out to only \$ 7.00 when converted into foreign exchange.

Asked if the increase in the basic price of crude oil would lead to further increase in the end prices of petroleum products, the petroleum ministry sources say that "the two are not quite related. A different price mechanism is applied to fix product prices". However, it is natural that the oil refining companies will demand a higher retention price in case the basic price is revised substantially. This will automatically push up the prices of petroleum products.

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## Meet to review PTA, DMT supply a fiasco

The joint meeting of representatives of polyester units and polyester intermediates convened recently by the directorate-general of technical development (DGTD) to review PTA and DMT supplies proved to be a fiasco.

The meeting, which lasted for 14 minutes, hardly gave an opportunity to several participants out of the 40 industry representatives to present their views on the problems being faced by the industry.

The deputy director-general (chemicals), Mr. N. Biswas, who chaired the meeting, said at the outset that he would leave the meeting after 15 minutes as he has to attend another meeting. He, however, left after nine minutes.

Mr. Biswas said that he would look into the polyester industry's demand for import of DMT and PTA to meet the shortfall in indigenous availability. He said that the DMT and PTA producers should assume that the 10 per cent cut in naphtha supplies would not be withdrawn. The producers should, thus, indicate their production potential keeping in view this reduction in supplies.

The representative of Bongaigaon Refinery and Petrochemicals said that his company has sought permission to import paraxylene to meet the shortfall

in its captive production facility. The company's DMT production will, thus, depend on the government's decision on its import applications. The Reliance representative said that if Bharat Petroleum Corporation applies a 10 per cent cut for July-March period of 1990-91, the monthly availability of naphtha would be reduced from 16,000 tonnes to 9,800 tonnes.

This, in turn, would result in reduction in the production of paraxylene and consequently of PTA. The representative of Indian Petrochemicals Corp. said that the naphtha supply cut, coupled with some technical problems in its xylene expansion project, would affect the production of paraxylene and DMT.

Mr. Biswas said that the demand for polyester is estimated at 330,000 tonnes for the current financial year. The industry would require the same amount of DMT and PTA to produce this quantity of polyester. At an earlier meeting with the industry representatives held on August 3, Mr. Biswas had estimated the demand for polyester at 305,000 tonnes and that for DMT and PTA at 275,000 tonnes each.

### ADDL. PETRO-GOODS IMPORT TO COST \$ 2360 MILLION

The current Gulf crisis is expected to

impose on India an adverse balance of payments impact of around \$ 2.8 billion in the 12-month period ahead, according to an official assessment.

The assessment, made available to the World Bank by India, says that the additional oil and petroleum products bill would be \$ 2360 million loss in remittances and non-resident deposits from West Asia would be \$ 200 million and exports loss to Iraq and Kuwait \$ 200 million.

The assessment of additional petroleum and petroleum products bill is based on crude oil price of \$ 25 per barrel. IMF had estimated that the price would stabilise around \$ 25 per barrel in the final quarter of 1990.

### TWO MAJOR TAMIL NADU PROJECTS CLEARED

The Union Cabinet has cleared the Rs. 1356-crore aromatic project being jointly set up by the Madras Refineries Limited and SPIC at Manali. This was disclosed by the Prime Minister, Mr. V.P. Singh, at a press conference at Madras on 22nd September. The Cabinet has also given its green signal to the 100 per cent export-oriented RPG-Linde naphtha cracker complex, also to be located at Manali. The proposed outlay for the project tops Rs. 1,000 crores.

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## Unicorn Organics to produce sorbitol

Unicorn Organics Ltd., a Hyderabad-based drug manufacturing company, is taking up the producing of mannitol, an import substitute, to augment its operations.

Executive director Sanjay Sandhani said his company's turnover would increase by about fifty per cent through this diversification process.

Unicorn Organics, which is currently engaged in the manufacture of sorbitol, is expecting to achieve a Rs. 7 crore turnover this year. The plant, which began commercial production in November 1989, achieved a turnover of Rs. 1.5 crore in the five-month period ending March 1990. According to Sandhani, the company will be able to wipe out its losses by March 1991. He is confident of declaring a maiden dividend of 10 per cent in 1991-92, operating at 70 per cent of the installed 7,200 tonnes capacity. Unicorn Organics meets half the sorbitol requirements of Hindustan Lever and Balsara. Its other clients include Colgate, E. Merck, Boots and several other blue chip companies. Unicorn Organics entered the field of sorbitol manufacture almost by default. Sanghani said the company had originally planned for the production of high-fructose syrup. But when the techno-economic feasibility survey was conducted, the production cost of high-fructose syrup was found to be unviable. As the equipment necessary for the manufacture of sorbitol was the same, and as the product replaces glycerine, which is in short supply, Unicorn Organics decided to take up the manufacture of sorbitol. The company expects to achieve a turnover of Rs. 10 crore in 1991-92.

### PHARMACEUTICAL RESEARCH CENTRE SOON

For the first time in the field of pharmacy, a modern centre for continuing pharmaceutical education, research and development is mooted in the country.

B.V. Patel Pharmaceutical Education, Research and Development Centre, on completion will prove beneficial to industrial pharmacists, pharmaceutical and ancillary industries, young pharmacy teachers, hospital pharmacists, retail pharmacists, students, researchers and is scheduled for opening on October 27 at Ahmedabad.

Located centrally on the Sarkhej-Gandhinagar highway, the Centre is being built up by Mr. B.V. Patel Education Trust on a 15,000 sq. mts. plot donated by Gujarat Institute of Chemical Technology.

To coincide with the inauguration, a three day international symposium on "Innovations in pharmaceutical sciences and technology" has been organised. The participants are eminent scientists from Belgium, Japan, USSR, UK and Netherlands besides our scientists. A unique exhibition on the theme

"Recent developments in pharmaceutical technology" has also been organised on the occasion to give exposure to the latest instruments, equipment and accessories in the field.

### DIRECTORY OF INDIAN CHEMICAL TECHNOLOGY SOURCES

Nandini Consultancy Centre, Madras is currently compiling a Directory of Indian Technology Sources for chemical projects in India. A product-wise listing of available technologies is envisaged.

Individuals/organisations who are in a position to provide technical knowledge for chemical projects are requested to get in touch with the Centre for inclusion of their names in the Directory. For further information contact Nandini Consultancy Centre, M-60, 4th Cross Street, Besant Nagar, Madras-600 090.

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## Burroughs tie-up with Japanese Co.

Burroughs Wellcome (India) Ltd. has signed an agreement with Fujisawa Pharmaceutical Company Ltd. of Japan, for marketing Cefprozime, a third generation cephalosporin antibiotic in India.

Negotiations are in progress with some other international companies for licensing of new drugs. The company also proposes to diversify into non-pharmaceutical chemicals to fortify itself against the effects of the changing governmental attitude to the drug industry.

These will be in line with the company's technical and marketing skills, and not in unrelated areas like consumer products whose attempt was given up some years ago, according to Mr. D.K. Bose, managing director and president of the company.

Apart from diversification, the company proposes a major export drive in coming years. Mr. Bose hopes to launch about 10 new molecules in the Indian market during the next five years.

Burroughs Wellcome recently launched acyclovir (for treatment of herpes), an original Wellcome discovery and the group's number one product worldwide. Another new drug, alprazolam, a surgical muscle relaxant, is expected to be launched later this year.

The company has declared a 16.25 per cent dividend on the increased share capital of Rs. 6 crores, for the 13 months ended 31 March 1990. Sales of medical products, net of excise duty, for the 13 months amounted to Rs. 68.13 crores as against Rs. 91.61 crores for the previous 18-month period — representing a marginal increase of three per cent on an annualised basis.

The post-tax profit for the period amounted to Rs. 192 lakhs as compared to Rs. 541 lakhs for the previous period. Profits have been eroded due to increase in input costs, overhead expenses and interest charges on depreciation of the rupee against foreign currencies, Mr. Bose said. Chairman, Mr. Keith Gay told shareholders that sales for the five months ending 31 August, 1990 showed an increase of over 26 per cent over the corresponding period last year, but cautioned that the future of the company and of the entire drug industry will depend more on the governments proposed review of the drug policy.

### SYNTHETIC SUGAR: SEARLE INDIA TO LAUNCH 'EQUAL' SOON

Searle India Ltd. plans to launch 'Equal', G.D. Searle's global brand of aspartame, by the year-end. Aspartame, a synthetic sugar, is an original disco-

very of G.D. Searle. Like other existing companies which market the product, Searle India too plans to import aspartame and formulate the chemical into table top products. The market for synthetic sweeteners is estimated at Rs. 2 crores at present, "Sacharin" holds almost 60 per cent of this market. There are four versions of aspartame in the market, the leading ones being "Sugarfree" of Cadila and "One up" of Torrent Laboratories. Worldwide, table top accounts for only 20 per cent of aspartame sales, the lion's share going into foods and beverages. "Diet Coke" and a host of other beverages and food products abroad are sweetened with aspartame. Unlike sacharin, which cannot be metabolised by the body, aspartame is a protein which is metabolised like any other protein within the body. One spoon of sugar has 16 calories. In contrast, one tablet of aspartame has only 0.4 calories for equivalent sweetness.

G.D. Searle has a separate company called Nutrasweet which markets aspartame, with sales close to one billion US dollars. Aspartame was discovered accidentally by Mr. James Schlatter of G.D. Searle and Co., United States. Mr. Schlatter, who was conducting an experiment, happened to lick his finger. Later he confirmed that it was crystallised aspartyl phenylalanine methyl ester (aspartame) that caused the sweetness.

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## Thapar-Du Pont tie-up in trouble

The Thapar-Du Pont collaboration for a series of joint ventures in the country is on the verge of snapping. The U.S. chemical conglomerate has refused to go ahead with new ventures with the Indian group unless the controversy over the Rs. 180 crore nylon 66 joint venture is settled soon. At stake because of this fresh Du Pont stand is a Rs. 110 crore project to manufacture Spandex Fibres and another Rs. 180 crore export oriented unit to make nitric acid.

According to a Thapar group source, Du Pont may well dismantle a team set up to look after the Thapar-Du Pont ventures. The outfit is reported to have already incurred an expenditure of \$1.5 million since it had been set up, with no results forthcoming.

Faced with the Du Pont deadline, the Thapars have agreed to make compromises to push the nylon 66 project through. They have offered to ensure

foreign exchange neutrality for the nylon unit. Foreign exchange drain has been one of the crucial issues which has bogged down the project with the Union government instead of the earlier proposal to guarantee Rs. 300 crore worth of exports over a five year period.

The Thapars are now willing to provide an export commitment in goods in which Du Pont is associated with. The government is reported to have demanded an export commitment in nylon 66 or in associated products.

In the previous proposal on export commitment, the Thapars had argued for being allowed to ship out consumer products. It was however, promised that such exports will be "additional" in nature and will not be conducted by buying up export licences. The Thapar-Du Pont application is now awaiting a final decision from the Union industry minister, Mr. Ajit Singh.

The project approval board in the ministry has already assessed the project and has asked the proposal be amended to allow for neutrality of foreign exchange outgo, export commitment in associated products and generation of finances for the erection of plant, including foreign exchange funds, through own resources.

The Thaper-Du Pont tie-up had faced rough weather right from the inception. Earlier proposals to make hydrogen peroxide had to be dropped on environmental grounds. Then again, an acrylic fibre venture in Himachal Pradesh got scrapped because of objections to import second hand machinery.

The nylon 66 project had been bitterly opposed by existing nylon 6 manufacturers who claimed that the entry of a multinational into this sector would wipe them off. They also campaigned that the project will entail a perpetual drain on foreign exchange because the raw material for nylon 66 will have to be fully imported.

The only joint venture application that has received government clearance is the one for manufacture of spandex fibres in Goa. The government has imposed an export commitment of 20 per cent.

### Rs. 52 LAKH US GRANT FOR DEPARTMENT OF CHEMICALS

The US Government's Trade and Development Programme (TDP) has made a grant of \$ 290,000 (Rs. 52.2 lakh) to the Department of Chemicals and Petrochemicals to help India plan for becoming a global, cost-competitive producer of engineering plastics.

The grant will fund the appointment of American consultants to assist the Department in preparing a feasibility study to set up a perspective plan for this goal. The US consultants will also advise the department on the establishment of application...

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# I.I. Chem. E. seminar on chemical industry: past, present & future

The Western Region chapter of the Indian Institute of Chemical Engineers conducted the Dr. H.L. Roy Birth Centenary Celebrations in Bombay on September 14. A one-day seminar titled "Chemical Industry: Past, Present and Future" was held to coincide with the Birth Centenary Celebrations. The seminar was addressed by Prof. M.M. Sharma, Director, Bombay Univ Department of Chemical Technology (UDCT). Two technical sessions comprising the presentation of five papers and a panel discussion were held. Prof. Sharma was earlier felicitated by the Association for being elected as Fellow of Royal Society.

## WELCOME ADDRESS

Touching upon the nature of the seminar, Mr. K.N. Venkatasubramaniam, President, I. I. Chem. E. noted that the country was planning major investments in different parts of the chemical industry. In the area of hydrocarbon exploration a sum of Rs. 50,000 crores had been ear-marked for the 8th Plan period.

Although these sums appeared significant, nevertheless they fell short of requirements bringing into play great compulsions to cut costs and slash project implementation times. Noting the difficulties associated with sourcing closely-held modern technologies from abroad, Mr. Venkatasubramaniam stressed the need to develop such technologies indigenously. The chemical engineers in the country as also associations such as the I.I. Chem. E. could play a major role by focussing attention on such technologies and priorities, thus helping to shape the contours of the country's developmental plans.

Congratulating Prof. Sharma on being elected Fellow of Royal Society, Mr. Venkatasubramaniam noted that the Association was indeed proud that one amongst their profession was thus awarded special honour.

## PROF. SHARMA'S ADDRESS

Acknowledging the honour bestowed upon him by the Royal Society, Prof. Sharma gracefully noted that a significant portion of the credit for such honours went to his students and colleagues. Commending the excellent work done by some researchers in the country, Prof. Sharma noted that inspite of adverse conditions such as lack of funds, paucity of research facilities etc. numerous Indian scientists were able to compete globally in an "unprotected" academic world. While industry always had barriers erected to protect their markets no barriers protected intellectual achievements made in the country, rendering them all the more creditable.

Commenting upon the current talk of raising the prices on petrol and naphtha, to offset global increases in prices of crude oil, Prof. Sharma noted that the Government was baking up the wrong tree. With both naphtha and petrol accounting for minor shares of the total consumption of crude oil products, such a policy would yield insignificant results.

## ENVIRONMENTALLY BENIGN TECHNOLOGIES

While elaborating on the methods Indian chemical industry would have to follow in the years to come, Prof. Sharma stressed the need for development of environmentally benign technologies. "The Chemical Industry has for too long been the favourite whipping-boy of the public". Ironically he noted that the very industry that was blamed for polluting the environment had the solutions for solving the environmental problems of today. Citing an example of chlorofluorocarbons (CFC's), Prof. Sharma noted that when introduced they were regarded as unreactive, stable wonder-chemicals, which provided us with luxuries such as refrigeration, air-conditioning and foams. Perceptions of such chemicals have

sharply changed in the wake of deep knowledge and today CFC's are on the list of chemicals, usage of which are to be seriously restricted.

## TECHNICAL SESSION

Three papers were presented in the first Technical session chaired by Dr. A.N. Dravid, Managing Director, Humphreys and Glasgow Ltd.

### Pharmaceuticals

The first paper titled "Indian Pharmaceutical Industry — the Past, Present and Future", was presented by Dr. D.J. Gupta, Chairman and Managing Director, Lupin Laboratories Ltd. The paper surveyed the current status of the country's pharmaceutical industry and suggested strategies to acquire a global place in pharmaceutical production.

While the Indian Pharmaceutical Industry has made progress since independence, production of bulk drugs was of comparatively recent origin. Although in absolute terms the pharmaceutical industry's turnover of bulk drugs (Rs. 3,500 crores) seemed sizeable, viewed as a percentage of the world market, the industry's size was dismal (1.5%). While accounting for 15% of world population the country barely accounted for 3% of the world pharmaceutical production although more than 10,000 units existed. While antibiotics, vitamins and anti-inflammatory drugs accounted for a major share of drug consumption, the coming years would see increasing need for anti-hypertensives, and anti-ulcer drugs, Mr. Gupta said.

Stressing the need to acquire global perspectives, Mr. Gupta noted that in order to obtain a sizeable export market it was necessary to have a significant local market. Citing the example of his own company, Mr. Gupta observed that Lupin Laboratories was able to achieve a 70% share in world ethambutol markets only because of the large market that existed in the country, which acted as a spring-board, catapulting

him into highly competitive global markets.

Stressing the need for strong R & D through interactions with Government institutions and laboratories, Mr. Gupta noted that the years to come would see a resurgence of chiral chemistry and biotechnology.

While noting that the achievements made in exports through innovative process design was laudable, the achievements of the industry were too few. With a large number of drugs shortly coming off-patent in western countries, a huge market was opening up for Indian companies to enter. However, Mr. Gupta felt that India very much being a part of the global economy, may sooner or later have to become a signatory to the Paris Convention.

#### Petrochemicals

Outlining the emerging scenario in petrochemicals, as seen at Indian Petrochemicals Corporation Ltd., Mr. C.J.

Bhat, who is in charge of the Technology Development Cell at IPCL, made the following observations as regards the shape of the petrochemical industry in the coming years:

- development of newer plants with reduced energy consumption. These plants will have to replace many existing plants working on out-dated technologies
- indigenous development of technologies for aromatics production, polyolefin manufacture as also naphtha cracking,
- development of liquid detergents which shall see increasing markets with the use of mechanised washing. LAB establishing itself as the chief active ingredient, but in use with other actives.
- increasing consciousness of environmental problems and consequent development of organised and efficient recycling technologies,
- increasing use of gas be it for

fertiliser, power or methanol production (Tripura, Krishna, Godavari) or petrochemicals (Gandhar). Mr. Bhat noted that alcohol would continue to play a vital role as feedstock, under the appropriate pricing policies.

#### Polymers

In his paper "Polymers — Perceptions of a Dynamic Industry", Dr. N.M. Dhuldhoya, (paper presented by Mr. V. Parasuraman), Managing Director, Polyolefins Industries Ltd., Bombay proposed that with conservation of energy and resources assuming crucial importance we are witnessing the "dawn" of the "polymer age".

The coming years will see the setting up of plants to produce the entire range of polyolefins at the same plant; upgradation, optimisation, and tailoring of properties, to make polymers better suited to meet consumer aspirations; increasing attention being paid to waste management through recycling techniques; application of a "designer-concept" to plastics through innovative processing techniques; newer applications in areas as varied as conductive polymers (rechargeable batteries, biosensors, remotely held indicators), medicine and surgery (artificial organs, contact lenses, joint replacements, artificial limbs, cardiovascular applications, drug release systems etc.) super absorbent polymers (personal care products, sanitary items, agriculture, and industrial applications). The paper visualised polymers to play the role of a "lead material" in the coming century.

#### TECHNICAL SESSION-II

Two papers were presented in the second technical session chaired by Prof. K. Vasudeva, Head, Department of Chemical Engineering, IIT, New Delhi.

#### Oleochemicals

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them an important class of chemicals, India's share of around 35,000 tonnes indicated the infant nature of this agro-based industry, according to a paper presented by **Mr. K.V. Mariwala**, Technical Director, The Bombay Oil Industries Ltd. The slow growth of the industry has been attributed to sluggish growth in the oleochemical consuming industries viz. personal care products, surface coatings, lube-oil additives, plastic and rubber additives and textiles. With good growth anticipated in at least plastic, rubber and textile segments, oleochemical consumption is estimated to triple to around 100,000 tonnes by the end of the decade. Introduction of alpha olefins as base materials for soaps and detergents should give a boost to the country's oleochemical industry.

The development of the oleochemical industry hinges around the supply of fats at reasonable prices after meeting the requirements for edible purposes and for soap-making. A strategy for ensur-

ing this would be:

- encourage collection of minor oil-seeds.
- encourage soap manufacturers to use technical oils.
- discourage use of castor oil in soaps.
- allow imports of fats for oleochemical purposes on priority over those for soap making.

### Fertiliser Industry

In this review of the fertiliser industry, **Mr. Y.R. Pakkala**, who is a consultant to Rashtriya Chemicals and Fertilisers Ltd., (RCF), stressed the need to undertake a retrofitting of vintage units with a view to lowering energy consumption and increasing capacity by around 10-15%.

With the commissioning of three gas-based fertiliser projects delayed well into the 8th Plan, the country may have to continue to resort to imports for some time to come. Reviewing the per-

formance of the nitrogenous fertiliser industry, **Mr. Pakkala** highlighted the high operating capacities of most units and their use of diverse feedstocks (naphtha, gas, fuel-oil and coal) with increasing reliance on natural gas. Newer technologies enabling smaller sized ammonia plants (400-600 tpd) to be viable could have a bright future in view of the location of small isolated pockets of gas in the eastern and southern parts of the country.

In the case of phosphatic fertiliser, the retrofitting of existing plants by bigger reactors, would increase production moderately. In view of the shortage of imported phosphoric acid, proposals for installation of nitrophosphate plants are expected to be considered favourably.

### PANEL DISCUSSION

The two technical sessions were followed by a panel discussion. **Mr. K. Mohandas Rao**, Managing Director

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Hindustan Dorr-Oliver Ltd. moderated the discussion which dwelt upon the current upheaval in the Gulf and the political re-alignments in Eastern Europe vis-a-vis its affects on the Indian chemical industry. **Mr. Ajay Taskar**, CEO, Industrial Perfumes Ltd., noted that with decreasing supply of crude, prices of solvents had firmed up in recent weeks. With markets becoming extremely competitive any increase in prices would have a serious impact rendering many products uncompetitive. Major export markets such as USSR and East Europe may have to be given up for exports into the more competitive General Currency Areas.

**Mr. Rama Iyer**, Managing Director, Davy Power Gas, saw opportunities for Indian Chemical Engineering firms, in the cleaning up operations currently on in the environmentally devastating chemical industry of Eastern Europe. The growth of countries in the Pacific Rim, including Indonesia, Malaysia,

Thailand offered opportunities for Indian chemical engineering companies. India was an "acceptable" name in these countries and could grab a significant presence, Mr. Iyer felt.

Mr. Iyer added that the Gulf crisis highlighted the need for greater self-reliance, be it through the more judicious use of the country's natural gas reserves or through incorporation of methanol in fuel, with a view to reducing consumption of petrol. **Mr. R.K. Marphatia**, Director, Goodlass-Nerolac Ltd., added that the present crude oil crisis would seriously affect the paint industry as prices of solvents had firmed. The crisis showed the relevance of research work on water borne coatings and powder coatings, which have the added advantage of being environmentally friendly.

#### Incineration plant near Bombay

Highlighting the efforts taken by the State Government in managing indu-

ustrial waste, **Mr. U.K. Mukhopadhyay**, Secretary, Department of Environment, Government of Maharashtra, announced that the Government had finalised plan to build an incinerator in the Thane area. The project, expected to cost about Rs. 90 crores is to get funding from the World Bank, in addition to assistance from the State and Central Governments. Mr. Mukhopadhyay wished that industry come forward to run the plant.

A treatment plant to handle liquid effluents was being planned at Domivli, a suburb of Bombay, where the mushrooming of small-scale industries had created a crisis situation.

In the long term a rigidly enforced locational policy for industries would need to be enforced, said Mr. Mukhopadhyay. The seminar concluded with a vote of thanks proposed by Dr. K.S. Hattangady Chairman, I. I. Chem. E. Bombay Regional Centre.

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Coal India Ltd. (CIL) and the Central Mine Planning and Design Institute have launched a 25 point strategy for environment safeguards in coal mine areas.

Under the plan, thrust has been given to identify non-pollution and no pollution technology in each coal mine. Official sources at Calcutta said that greater use of remote-sensing and other modern techniques for evolving land use and environmental thematic map was one of the objectives.

Mining authorities had taken dust control measures besides using chemical additives for dust suppression for controlling air pollution, sources said.

Stress was also given on improvement of work and living places besides detecting and preventing occupational diseases associated with mining and rehabilitation of affected miners.

The authorities had also taken up measures to arrest land degradation owing to mine fires in Jharia Coalfield.

## MINI-REFINERY AT NAGAPATTINAM

The Public Investment Board has okayed the proposal for a mini-refinery at Nagapattinam in the oil-rich Cauvery basin.

Announcing this at the 24th annual general meeting of Madras Refineries Ltd, at Madras recently, the Chairman Mr. H.Krishnamurthy, said the project will be executed soon after final clearance from the Cabinet Committee on Economic Affairs.

The refinery, estimated to cost Rs. 114 crores, will process crude from the Cauvery basin.

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Products which meet certain environmental criteria in the manufacturing process may in future carry a special EFP (environmental friendly product) mark. The Ministry of Environment and Forests which has prepared a paper on this scheme hopes that if it is accepted it may encourage consumers to buy environmental friendly products and this may in turn put pressure on companies to change their manufacturing processes.

The Ministry would like to give the EFP mark, much as the ISI mark is given to approved products. The paper prepared on this scheme by the Ministry has been circulated to other concerned ministries and departments as well as non-Governmental organisations. A list of products which use processes least harmful to man and the environment would be drawn up, for example, phosphate-free detergents and recycled paper. Simultaneously, the Ministry proposes to inform the people about these processes so that consumers can make positive decisions when buying these products.

An independent institution would also have to be set up to administer the scheme, test the products, inspect the manufacturing facilities and award the EFP mark.

### SOAPS, TOILETRIES MAKERS PLEAD FOR EXCISE DUTY CUT

Soaps and toiletries makers have pleaded with the centre to scale down the high excise duty of 110.25 per cent on their products to the levels prevailing on other consumer products such as processed foods. Mr. P.M. Sinha, president, Indian Soap and Toiletries Makers Association, said the high excise duty resulted in a mark up over 11 per cent on ex-factory cost even on

## SPECIAL HONOUR TO PROF. SHARMA

## ICMA awards presented to Lupin, Hind. Polymers &amp; Grasim

The Indian Chemical Manufacturers Association's (ICMA) awards for outstanding achievements in the chemical industry were presented to three companies viz. Lupin Laboratories Ltd., Hindustan Polymers Ltd. and Grasim Industries Ltd. at the hands of Shri M.S. Gurupadaswamy, Union Minister for Petroleum and Chemicals at a well-attended function in Calcutta on September 22, 1990.

A special award was conferred on Professor M.M. Sharma, F.R.S., Director, University Department of Chemical Technology, for his outstanding contributions to the Indian Chemical Industry. The award carries a citation and a sum of Rs. one lakh. This is the first time that ICMA has chosen to honour an individual for his/her contributions to the chemical industry.

Lupin Laboratories Ltd., received the Acharya P.C. Ray Award for Development of Technology Indigenously for its outstanding contributions in the development of technology for the commercial production of Vitamin B<sub>6</sub> for the first time in India, using a complex eight-step organic synthesis.

The award to Hindustan Polymers Ltd., a UB group company, was for its unique achievement in commercialising for the first time the production of ethyl benzene using a one-step non-conventional alkylation process involving dilute ethyl alcohol and benzene in presence of a specially structured catalyst developed at National Chemical Laboratory (NCL), Pune.

NCL, Pune bagged two special citations, one for pioneering the synthesis of Vitamin B<sub>6</sub>, and successfully transferring it to Lupin Laboratories Ltd. and the other for developing the process for manufacture of ethyl benzene directly

from alcohol and benzene, using a novel zeolite-based catalyst system.

United Catalysts India Ltd., also received a special citation for its outstanding role in developing the structural zeolite catalyst based on the know-how from NCL, Pune.

The ICMA award for export of chemical plants and for engineering services rendered overseas was awarded to Grasim Industries Ltd., Nagda (M.P.) for successfully exporting a complete viscose rayon fibre plant to Thailand and also providing technical know-how and consultancy services for chemical plant projects such as acrylic fibre, sulphuric acid, effluent treatment etc. to a number of countries.

The Award function also coincided with the 50th Annual General Meeting of the Association.

## PRESIDENTIAL ADDRESS

Welcoming the guests at the AGM, Shri Atmaram Sarogi, President, ICMA presented a canvas of the Indian Chemical Industry against the backdrop of unparalleled changes in the world-wide economic order, and the gathering clouds of war in the Middle-East. "Economies of the third world countries like India are particularly vulnerable by these unhappy developments", he said.

## Shift to speciality products

Looking into the future of the chemical industry in India, Mr. Saraogi saw a definite shift into the production of more value added chemicals involving extensive application of science, technology and human skills. "The development of the chemical industry calls for a carefully planned approach having regard to the demand for various chem-

ical and petrochemical products and their intermediates, the indigenous availability of feedstocks, raw materials and most of all, the risks and opportunities costs of a policy of continued dependence on imports to meet substantial part of the domestic demand", he noted.

## Augmenting indigenous production

Stressing the need to ensure adequate supply of raw materials for dyes, drugs and agrochemical sectors, Mr. Saraogi suggested an augmentation of capacities. "Otherwise, end-user units particularly in the small scale sector will be badly affected leading to closure and unemployment", he said.

The 10% cut in supply of naphtha needs urgent review, felt Mr. Saraogi adding that the cut will result in a fall of thirty five to forty thousand tonnes of products down the line. With most of these chemicals on OGL any curtailment of domestic production will result in increased imports necessitating higher foreign exchange outgo.

## Good scope for exports of agro-based chemicals

Chemicals from agro sources is a particularly promising area for exports with a very high value addition feasible, felt Mr. Saraogi. "West Germany which imported medicinal plants worth Rs. 700 crores in 1986, exported value added products worth Rs. 41 crores -- a value addition nearly six times. We in India exported medicinal plants for Rs. 700 crores in 1987. Assuming only a 300% value addition, we could have earned foreign exchange worth Rs. 230 crores if a proper approach was adopted."

## More crackers urged

Going on the basis of projections made for petrochemical consumption

Mr. Saraogi saw the need for setting up atleast one ethylene cracker of 300,000 tonnes capacity every three years, amounting to a total of atleast four crackers by the year 2000 AD.

"We request early action in clearing pending proposals to avoid persistent shortages as well as cost over-runs. Government should also announce a policy decision that atleast ten per cent of ethylene from these units will be available for merchant sales to cater to the needs of independent processors".

Mr. Saraogi also urged the government to find an early solution to utilise 17 million cubic metres of gas being flared everyday.

#### Alcohol based industry

Stressing the need to ensure adequate supplies of alcohol to the chemical industry, Mr. Saraogi noted that "before committing alcohol and molasses for exports, it is necessary that the capacities of these (alcohol-based) units are fully utilised. To that extent we may be able to reduce the pressure on petroleum feedstocks or dependence on imports.

#### Location Policy

Highlighting the urgent need for creating a buffer zone around chemical plants, Mr. Saraogi noted that without such a condition, the Government's plan for introducing a Public Liability Insurance Scheme to provide for liability claims in case of an accident, will have no practical utility.

#### Employment generation

While admitting that the petrochemical industry was indeed capital intensive, Mr. Saraogi noted that downstream units were on the contrary labour intensive. "These processing units can be dispersed far away from the naphtha/gas cracker, thus achieving the objective of wide dispersal of industries and creation of employment opportunities on a

regard to other units engaged in the manufacture of basic chemicals. Growth of this industry will promote employment in a variety of sectors catering to the chemical industry needs".

"In the final analysis therefore, while direct employment may not be large at the primary level, the sum total of employment streams as a result of investment in this sector does not point to an unfavourable picture", Mr. Saraogi added.

In concluding his address Mr. Saraogi made mention of the close interaction that ICMA had had with CSIR laboratories and the scientists of NCL in particular. "Our experience in recent years has given us encouragement about future scope for such useful interaction. It is therefore proposed to hold similar meetings with Indian Institute of Chemical Technology, Hyderabad and the Central Electro-Chemical Research Institute, Karaikudi in respect of electrochemistry and with various IITs".

#### ADDRESS OF CHIEF GUEST SHRI M.S. GURUPADASWAMY

In his address to the audience, Shri M.S. Gurupadaswamy, Minister for Petroleum & Chemicals, threw light on the thinking of the Government on various policies.

While commenting on the vital role played by the chemical industry in providing important building blocks going into the manufacture of downstream industries like drugs, agrochemicals and petrochemicals, Mr. Gurupadaswamy stressed the need to renovate plants with upgradation of technology.

"This is an area of priority for the government and we would give all encouragement to technological upgradation. I lay great emphasis on indigenous R & D not only as a long term objective but also in the short term, given the foreign exchange crunch that the country is facing. But these con-

that whenever indigenous technology not available and foreign technology a must, my ministry would certainly permit such an import".

#### Energy conservation

Another major concern of the Government, said Mr. Gurupadaswamy was energy conservation, particularly in view of the pressure presently faced by the Government in procuring petroleum products. "Recently my ministry had to impose certain cuts on the use of petroleum products like furnace oil and naphtha. We would not like to stifle the production of chemical products on this account, but the situation is such that there is simply no alternative to imposition of these cuts.

"Therefore, it becomes all the more necessary that our industry, particularly the chemical industry which is energy intensive, intensifies its efforts for developing technologies which result in substantial energy savings. What I have mentioned just now is the immediate reason but even in the long run it is in the interest of the industry also to develop energy saving technologies and devices since energy in general and power in particular is an important component in the cost of chemical products and if we are to make products which are internationally price-competitive, efforts in this direction must be redoubled. We on our part in the Government have already constituted a Cell headed by a Joint Secretary which is working in my Ministry on energy conservation and application of suitable measures and I would like a better interaction between the Government and the Industry on this subject so that duplication of efforts is avoided and optimum results achieved."

#### Environmental concerns

Another major area of concern for the chemical industry which is being highlighted not only in India but worldwide

al, conservation and pollution control is also safety in manufacture, said Mr. Gurupadaswamy. "The chemical industry the world over is perceived as highly polluting and environmentalists in some of the advanced countries in the West have gone to the extent of demanding shifting some of the existing chemical plants from their present locations. Given our present state of development, I would not like to go to that extent, but to emphasise to you the need for adopting technologies and measures which ensure that the industry does not pollute the environment. Sometimes the argument of cost of installing such equipment being prohibitive is put forward on behalf of the industry. But I am afraid that this is something which cannot be accepted since no cost is high enough to ensure not only the survival but also a good quality of life for our future generations and I think that the industry which derives so much from the society it operates in owes at least this much to the society. I am sure that all of you share my concern on this issue. You are all aware of what happened in 1985 in Bhopal when we had to suffer one of the world's biggest industrial disasters. You are also perhaps aware that we are still suffering from the fall out of that disaster. The magnitude of human suffering that the Bhopal gas leak disaster caused cannot be imagined since in a large number of cases the gas leak has

not only affected the present generation but also the future generations. I would like all of you who are operating in this sector to see to it that whatever be the cost, such an accident does not recur. Government has been laying great stress on this aspect and strict rules have been laid down for pollution control and for providing adequate penalties for their contravention. In fact, in some case we have also put restrictions on the use of technologies which are polluting."

#### Exports and the uncertainties

While commending the chemical industry's contribution to the total exports of the country, Shri Gurupadaswamy noted that the trade scenario likely to evolve with the unification of Europe and the opening up of markets in E. Europe, was still unpredictable. "The industry should be prepared to face these challenges and should have the necessary flexibility and the resilience to do so," he said.

#### Customs problems

"I am aware of the fact that you have some problems particularly those relating to customs and excise matters and you have been raising these from time to time with my Ministry. Government has to keep in view the interests of the consumers as well as the industry and strike a balance while taking a decision

on representations received from different sectors of industry on these matters. While Government would like to protect the indigenous industry against unfair competition from abroad, it cannot, at the same time, ignore the interest of the consumers. In the case of chemical sector it so happens that sometimes some of your members are the producers while others are the consumers and we get conflicting representation in these matters. In all such cases, we do try to take a balanced and a fair view but ultimately it is the Ministry of Finance which has to take a final decision on matters connected with customs and excise duties and my Ministry is a recommendatory authority. I would like you to remember that Government has to take a much larger view of things before taking decisions in such matters and it is possible that in some cases what may be justified from your limited perspective may not fit into the overall context. Nevertheless, I would like to assure you of the support of my Ministry on merits in respect of genuine problems on this account", the minister concluded.

The minister's address was followed by an illuminating key-note address by Prof. M.M. Sharma. We reproduce in the following pages, the text of his address titled "The crucial role of the chemical industry and technology as an instrument of growth".

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# The crucial role of the chemical industry and technology as an instrument of growth

M.M. SHARMA

University Department of Chemical Technology, Matunga, Bombay 400 019

The chemical industry (CI) carries out manipulations of molecules on a grand scale and produces a bizarre spectrum of products which are essential to the needs and desires of the society. We do live in a chemical age. The scale of operation can be a few kilos per year of sophisticated speciality product, selling at over Rs. 200,000 per kg. to over 1 million tonnes per annum (tpa).

The CI is highly science based and is one of the most successful industries globally. We produce ultrapure isomers as one isomer may be a drug and the other a poison (or one isomer can be sweet and the other bitter!). Indeed the CI has perhaps the world's largest privately financed R & D budget and in some pharmaceutical and performance products the R & D expenditure could be 15% of the turnover.

We often produce chemicals where impurities are specified at ppm or even ppb level and the CI has a good track record of managing innovations. It would not be an exaggeration to say that we in the CI are proverbial "problem solvers". The CI is an enabling industry and from transport sector to communications to leisure and pleasure you can witness the ubiquitous nature of chemicals.

The spectacular success of the CI in the world during 50's and 60's was due to ready availability of inexpensive feedstocks and good process design well linked to R & D. The petroleum companies virtually raided the "petrochemicals" sector and now occupy a pivotal position.

Today the CI is one of the few indus-

trious issues of feedstocks, technology advances, forward and backward integration, geographic and customer diversification, availability of technology, environmental and safety factors, research intensity, etc. We in India must become innovators and not persist as imitators.

Before leaping into the future a peep into the past should provide proper lessons. Our superfine penchant to sieve every issue so superbly has guaranteed for us shortages and ensured a safe haven for our sales executives to be essentially rationing officers. Let us ponder dispassionately why our forecasts have repeatedly gone wrong and always been on the lower side. Can we at all plan on the basis of quantities imported? Can we not free ourselves from so many "ifs" and "buts"? Can we not free our economy? There are isolated incidences where we have taken bold initiatives although strategically not very sound in some cases. Take the case of linear alkyl benzene which will be the only chemical that India hopes to produce at a level of 15% of the world production. Here we will use scarce paraffin from the kerosene fraction and downgrade our kerosene apart from encroaching on its limited availability. A host of feedstock for surfactants can come from ethylene in turn derived from ethane in natural gas.

Our scale of operation has been most unsatisfactory in vast majority of cases. The integration between refineries and basic building blocks is unsatisfactory. Let us remind ourselves that China has a single location 450,000 tpa p-xylene plant and Indonesia is heading for a single location 250,000 tpa purified

much higher capacity for polypropylene than our planned production upto 1995.

We must plan for the production of key chemicals at a level compatible with most liberal demand pattern and not with a "stiff" pattern and let exports act as flywheels in the interim short term period, if a situation so demands. We are about 15% of the humanity and surely at least in some major sectors, we ought to be producing at least 3% of the world production.

## Vital role of hydrocarbons

It is axiomatic to say that hydrocarbons will continue to be the key raw materials. In our own context even by the year 2000 the percentage hydrocarbon earmarked for petrochemicals will not certainly cross 7% for a big quantum jump in our production. We must mop-up all ethane and propane from natural gas throughout India, besides butane/isobutane. We can develop technology to recovery as low as 2 to 3% ethane in methane even if the quantum is 50,000 tpa. LPG is a relatively free commodity to negotiate from our neighbouring countries and our requirements are large and this provides a propitious situation to top-off propane to support production of propylene on "stand-alone" basis in locations where we do not have natural gas like in Southern India.

The total amount of ethane and propane in natural gas from Western and North Eastern India, based on declared possible levels of production leave alone the actual potential, is such that we can manufacture more than 1.5 mtpa of olefins. We need to remind ourselves that very little additional propylene can

Our record of utilisation of  $C_4$  olefins from cat-crackers continues to be poor; butadiene is allowed to be imported and production of synthetic rubber is a necessity. Why cannot we correct this position? It is a poor choice to burn olefins as LPG.

We should become a world force in polyester fibers and filaments and have a unique position of proper integration between basic raw materials to finished fabrics. If proper steps are not taken we will be left far behind China, Indonesia, Taiwan, etc. We ought to develop fabrics which are suitable to our climatic conditions. Even in the case of polyamides we have inherent strengths to be a global force and we do not have to worry about utilisation of 4 to 5 tonnes of fertilizer per ton of caprolactum. Time has come for us to support non-wovens and geotextiles.

The aromatic content of our Bombay High naphtha and naphtha from other Indian crudes should be fully exploited. Thus apart from polyester fibres/filaments and caprolactum we should be a large producer of the versatile feedstock styrene and polymers like polystyrene. The present position of styrene/polystyrene is deplorable.

Polyethylene is perhaps the most versatile thermoplastic free from any "ifs" and "buts". Our packaging industry will depend heavily on this material besides polypropylene and polystyrene. We must give all the impetus to this vital sector.

Engineering plastics have become an essential requirement. We need to recognise that steel requires incredibly high investment and aluminium is an energy guzzler.

When olefins cannot be made from gaseous feedstocks in some locations in India and the use of naphtha becomes a necessity then we must valorise about 45% of the co-products of the naphtha cracker to higher value added products and the incremental value can largely

mitigate the drain on the foreign exchange associated with the import of crude oil. In fact, both in gas crackers and naphtha crackers we can conveniently put up, based on by-product hydrogen, 500 tpd ammonia plant.

In locations like North Eastern India we can put up 200,000 to 300,000 tpa methyl tert-butyl ether (MTBE) plant and MTBE can be easily transported and used as an effective additive with petrol or provide as a raw material to make butyl rubber from isobutylene. In U.P. we can consider making ethyl tert-butyl ether (ETBE) which is a very useful additive for gasoline.

The manufacture of alpha-olefins has been unduly delayed and this also provides me an opportunity to stress the importance of the so-called "exclusive" technology held by a club of three companies. In 1982, at the time when we were planning for MGCC, Gulf Oil (now part of Chevron) was keen to offer us technology but today we are in an awkward situation. The alpha olefins in  $C_6$ - $C_{18}$  range are extraordinarily versatile and right from LLDPE/HDPE co-monomer application of  $C_6$ - $C_8$  olefins, we will find purposeful outlets of  $C_{12}$ - $C_{16}$  olefins for surfactants. We will unquestionably need higher alcohol ethoxylates for washing of synthetic fabrics.

It would be prudent for us to supply natural gas to a cluster of sugar plants (off the HBJ pipeline to start with) and produce paper from bagasse on a large scale which can sum up to 1 mtpa. This will be also an excellent opportunity to upgrade boilers in sugar plants to rating of 46 atm or even 70 atm and generate surplus power for the grid. Further, this will enable power plants in sugar factories to be run throughout the year and the use of bagasse will prevent denudation of forests. These plants in turn will generate on-site capacity for large scale production of caustic soda and chlorine and by-product hydrogen can also be used advantageously.

## Speciality Chemicals

This area can be converted into a "niche area" as our "Knowledge Engineering" base is diverse and strong and potential is high. Thus, in the area of bulk drugs, where for some of the vital materials patents will soon expire, we can launch ourselves in an aggressive way. It is worthwhile to remember that as of today our total production of pharmaceuticals is less than the world wide production of a single ulcer drug. We should assiduously plan this sector and let inter- and intra-corporate wars not come in the way of the nation. Similarly we can embark more aggressively in the area of agrochemicals.

It is often not recognised that even in perfumery and flavour area the world market is of the order of Rs. 10,000 crores per annum and we are surely a "sleeping" giant.

Textile industry was our mother industry and we need to gear up to make high priced speciality chemicals for textiles (and leather) and new types of dyes and pigments. We have not yet added a new dye in the world market even though there are no statutory problems like those in the introduction of pharmaceuticals and agrochemicals.

We can certainly make ripples and be 'special'.

## Essential Role of Technology

The key for success lies in being a player globally and in a position of respect as knowhow sellers in some selected areas. Our national pride must propel us to be so, quite apart from rich business prospects. The history of the CI tells us that the future hinges on "Selectivity Engineering" and processes which are intrinsically safe and benign on environment and energy. For this endeavour expertise in catalysis is essential and we have to gear up for astute scale-up and process design backed up by intensive R & D. In fi

chemicals we can perfect the logic and art of selective synthesis. Our R & D costs will be well below 10% of that in the developed nations. Investment in this vital equity capital must be made a requirement and our orientation from fiscal policies as kingpin should immediately change over to technology as the pacesetter. Let us vigorously support pioneering researchers lest they become endangered species and become extinct.

It is often said that in many areas in India the scale of operation is not large enough to support viable R & D. This is baseless as is evident from the areas of bicycles, sewing machines, ceiling fans, two-wheelers, etc. apart from the largest sugar industry in the world. In none of these area we have made any ripples! In the case of the majority of two-wheelers and three-wheelers we still support two-stroke engines which by-pass, on the whole, 25% of gasoline and this is not only an avoidable waste but it creates a serious health hazard in urban areas where these are used extensively.

### Concluding remarks

The CI is an absolute necessity for the society and there isn't any option but to support this vital sector aggressively and purposefully. This industry merits more respect and attention from the planners and the society than what it has received so far. The future is exciting and rewarding and the scope is boundless.

The captains of the CI should recognise that technology is capital of the most expensive kind equity capital and should be invested as an act of faith and not divested. We should pursue the path of generating exclusive technology, in selected areas, as an instrument of growth and launch ourselves as 'Technology sellers' with services of diverse kind. Let the general atmosphere of undue caution not haunt us and reduce the propensity for taking risks. After all no technology is ever mature. Creativity

thrives on uncertainty, freedom and iconoclasm. Innovation ought to be an essential part of our journey and not destination. Even to absorb and adopt purchased technology we need strong R&D culture. In any case we need to remind ourselves, rather painfully, that when we buy technology it is unquestionably second hand and unless it is buttressed by our own efforts we will be soon left behind. The history of the CI is replete with examples, with singular regularity, that new technologies are more efficient in raw materials, benign to environment and consume much less energy. We should be acutely aware of this picture and the repository of technologies in fertiliser sector in India is an eloquent testimony to our dilemma.

The ICMA, the captains of the CI, educators and researchers should bring out in a rational way the vital nature of our industry, its intimate and necessary linkage with essentials of daily life, and communicate to the society at large that we are a responsible industry and care for the environment. The CI has a track record of converting liabilities into assets and, apart from some solitary examples, has an enviable record of safety globally and this may be compared with the other sectors like mining, construction, transportation etc. and we will unquestionably come out very well.

Our national pride ought to catapult us in a position of strength globally.

## HERO J. CHUGANEE -- I.C.M.A. PRESIDENT

Mr. Hero J. Chuganee, Chief Executive of Indofil Chemicals Company has been elected President of Indian Chemical Manufacturers Association for the year 1990-91.



Hero J. Chuganee

After graduation from Bombay University, Mr. Chuganee proceeded to England, to complete his Post-Graduate studies in Chemical Engineering from Batterseas College of Technology, London. He is a Member of the Institute of Chemical Engineers (M.I.I.Ch.E.). Mr. Chuganee completed a course in marketing management. He has also completed

the Advance Management Programme (AMP), at Harvard Business School in Boston, U.S.A.

Mr. Chuganee started his career as chemical engineer in England and after serving for two years over there he returned to India in 1959. For six years, he worked in the paint industry in senior managerial levels. Thereafter, for three years, he worked in the field of industrial gases. Mr. Chuganee joined Indofil Chemicals Limited in 1971, as Marketing Manager, which position he held until his appointment as General Manager in July 1980. He was elevated to the position of Chief Executive of the company in May 1981.

Mr. Chuganee is also the chairman of Amber Chemicals Private Limited and General Manager of Rohm and Haas Asia Inc., Bombay operations.

Mr. Chuganee has been associated with various trade organisations/associations like Indo-American Chamber of Commerce, Indo-American Society and Leather Chemicals Manufacturers Association.

## Vitamin B<sub>6</sub>: A closely guarded technology

The process for manufacture of Vitamin B<sub>6</sub> like those of a number of other drugs has been till late a closely guarded purview of only two companies viz. Hoffmann La Roche, and Merck, Sharp and Dohme. Keeping in view the importance of this vitamin, scientists at the National Chemical Laboratory, Pune led by Dr. T. Ravindranathan in the organic chemistry section commenced work on the indigenous development of the vitamin.

The research work was initiated in the early 80's by Dr. A.V. Rama Rao, currently Director, Indian Institute of Chemical Technology, Hyderabad.

The synthesis is an eight-stage one involving at each stage complex separation and purification processes to ensure that no side-products and impurities are carried forward into the next step. The cyclisation step, forming the

pyridoxine ring structure is extremely critical and the NCL process gives better yields and selectivities.

The product obtained in a laboratory scale conformed to the specifications of local and international pharmacopial standards such as IP, BP and USP. NCL scientists then teamed up with Lupin Laboratories Ltd. to scale up the process to the pilot plant level.

Then followed a period of extensive experimentation at the pilot-plant level to improve the yield and to generate design data. Two years of work led to the development of the commercial process.

The commercial process offers quality product at competitive prices (in spite of high cost of indigenous raw materials) using indigenous plant and machinery.

The ICMA has chosen to honour Lupin Laboratories Ltd. for this outstanding achievement.

The company should now be able to stand tall in a field dominated by few multinational giants. The company already has a world-presence in ethambutol, accounting for a seventy percent share of the world market; probably the only instance of any Indian firm having such a strong market share in any product world-wide. Lupin has also successfully developed the technology for manufacture of Rifampicin, cephalosporins and agrochemicals such as monocrotophos and phosphamidon, indicating the stress the company lays in achieving self-sufficiency in technology.

"This award will act as an incentive to strive for further excellence", said Mr. Nitin Jaywant, Works Manager, Lupin Lab. while accepting the ICMA award.

## Albene technology — efficient utilisation of alcohol

The single-step manufacture of ethyl benzene, from dilute ethyl alcohol and benzene, is a result of a collaborative effort between the NCL, Pune, Hindustan Polymers Ltd. (HPL), Vishakapatnam, and United Catalysts India Ltd.

(UCIL), Bombay. While NCL and HPL jointly developed the process, the zeolite catalyst (Encilite-2) was produced by UCIL, based on technology supplied by NCL.

NCL's thrust over the years has been

in the development of catalysts leading to novel processes, which will cut down raw material costs, energy costs and lead to better environmental compatibility. By the development of a series of catalysts based on zeolites, NCL

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hopes to develop a number of processes with the above aims in view. The Albene technology is just one of the examples of this plan for technology upgradation through innovative use of catalysis.

The catalysis team at NCL, headed by Dr. Paul Ratnaswamy have been the architects behind this process, and commenced work on this process in 1980 and the first patent was filed in 1982. Within three years, the process was optimised at the laboratory level. It was at this stage that Hindustan Polymers Ltd. entered the act. A two tpd pilot plant was initially set up and its success saw the setting up of the first commercial plant in 1989.

Salient features of the project are:

- alcohol is totally converted
- environmental problems associated with handling corrosive Friedel-Craft type catalysts are avoided, so also the problems of handling ethylene gas
- there is a 10% cut in raw material consumption costs
- there is a 8% cut in energy costs
- ethylbenzene through this process is cheaper by Rs. 800 per tonne over that produced by the conventional process.
- plant maintenance and operation is easier.
- capital costs for the plant are lower. For a 25,00 tpa styrene plant, the savings are about \$ 2 million
- catalyst required is indigenously available and so are all equipment, resulting in substantial savings in for-

eign exchange.

### Catalyst development

The special zeolite catalyst, the heart of the new process is a product of collaborative effort between NCL, PU and UCIL, Bombay.

While the basic process was developed at NCL, subsequent scale-up to commercial process was the work of UCIL. The catalyst is made by a single-step environmentally clean process and can be regenerated any number of times. "The development of this catalyst should have a world-wide impact and we plan to export about 15% of our production", says Mr. S.K. Basu, Executive Vice-President of United Catalysts India Ltd.

## Grasim — Foreign exchange through consultancy

Grasim Industries Ltd., has today emerged as the largest producer of various grades of viscose staple fibre and speciality fibres in the country. The company has joint ventures abroad for manufacture of viscose staple fibre and carbon black.

Grasim, through its Consultancy and Engineering Development division is now in a position to offer complete know-how for a number of projects including acrylic fibre, sulphuric acid, carbon disulphide, palm oil, effluent treatment etc.

In-house R & D efforts have paid the company rich dividends and it has the distinction of winning a number of awards, the latest being the ICMA award for Export of Chemical Plants and for engineering services rendered overseas.

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## Oswal's project clears hurdles

The Rs. 695-crore fertiliser plant of the Oswal Group in Shahjahanpur has finally overcome all hurdles, thereby putting an end to a long-drawn uncertainty that the project would not come up at all. In a latest development, the Oswal's flagship company, Bindal Agro, has sorted out all its differences with Gas Authority of India Limited (GAIL) over the terms on which the latter would supply gas.

In a compromise formula, GAIL has assured payment of about eight per cent interest on the Rs. 4-crore security which Bindal Agro would deposit. It may be recalled that Bindal Agro had initially refused to deposit Rs. 17 crores (Rs. 4 crores as security and Rs. 13 crores as bank guarantee) with GAIL which the latter had said it would forfeit if the former does not lift adequate measure of gas from HBJ pipeline. However, later Bindal Agro agreed to deposit the amount on a condition that GAIL would pay interest on the security amount, which was agreed to by GAIL after prolonged deliberations.

Now that the main problem has been resolved, it is only a matter of time the company would get other clearances like the capital goods (CG) import clearance. This was announced by the Oswal Group Chairman, Mr. Abhay Oswal.

However, the project cost would now go up by Rs. 17 crores because of these deposits the company would have to make with GAIL. The revised cost of the project would hence be Rs. 712 crores, Mr. Oswal said. He said the zero date would be announced soon and the projects would be set up within 24 months of the zero date. He expected the project to go on stream by October 1992 without any cost overruns.

Mr. Oswal said the project on completion at a full year working would contribute a turnover of Rs. 350 crores. Considering the recently announced

policy for providing subsidy on production of fertiliser (based on 15 years depreciation), the plant would post a cash profit of over Rs. 150 crores per annum.

The UP Government has granted the environment clearance to the project. Vendors for supply of major critical and long delivery equipment have been identified after global tendering by PDIL. Orders for equipment would be placed immediately on receipt of CG import clearance, he said. Disclosing half-yearly results of the company, Mr. Oswal said operating income has increased by over 25 per cent to Rs. 74.43 crores against Rs. 59.46 crores for the corresponding six months ended June 30, 1989. The profit before tax and depreciation has increased by about 37 per cent to Rs. 12.05 crores against Rs. 8.78 crores during the six-month period of last year. Regarding the company's petrochemical plant at

Rishra, Mr. Oswal said the unit is expected to do 'extremely well' this year. The operating income for the current year is estimated to be over Rs. 150 crores against Rs. 127.54 crores in the previous year. The exports for the current year are expected to be around Rs. 12 crores. The net profit is expected to be around Rs. 20 crores against Rs. 13 crores last year and the net worth would touch at Rs. 190 crores at the close of the year.

### HERDILLIA CHEMICALS

Herdillia Chemicals has claimed that all production units are operating smoothly despite discontinuance of certain raw materials from the Thane Plant of National Organic Chemical Industries Ltd., (NOCIL). According to a company spokesman, phenol prices have risen not because of a shutdown of its plant, but because of the shutdown of Hindustan Organic Chemicals Ltd's Cochin phenol plant.

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## BACK-DOWN ON EXPORTS

**Rs. 187.50 crores Tatas stake in HPL**

The annual general meeting of Tata Tea Limited recently approved a maximum participation of Rs. 187.50 crore by the company and its associates in the share capital of Haldia Petrochemicals Ltd., (HPL).

The actual commitment of the company, would however, be determined after its associates — Tata Chemicals and Tata Engineering and Locomotive Company (TELCO) — finalised their share of the investment. Both Telco and Tata Chemicals would also be assisting in managerial and technical matters of the Haldia project.

Addressing shareholders at the meeting held at Calcutta, Mr. Darbari Seth, Chairman, Tata Tea, said that an application had been made to the Industrial Development Bank of India (IDBI) for term rupee finance so that IDBI could

take advance action to appraise the project even as Tata Tea, the private sector partner in HPL, gathered and furnished the required additional information.

The meeting also allowed issue of zero-interest fully convertible debentures (FCD's) to raise Rs. 110.32 crore to part-finance Tata Tea's commitment in HPL. Speaking to newsmen after the meeting, Mr. Seth said that there had been considerable progress in talks between West Bengal Government and the Centre on supply of naphtha on a priority basis for HPL. HPL would greatly benefit from the participation of Tata Chemicals and TELCO who would provide valuable expertise on the chemical and engineering aspects of the project, he added.

The Tata Tea Chairman scotched rumours that Tatas were no longer keen

to go ahead with the long overdue project. "We don't play games at Tata. When we take up a commitment, we fulfil it to the hilt", he said. He also stressed that the viability of the project was beyond doubt and it would be completed four years after a proposed "zero date".

Mr. Seth said the proposed expenditure of Rs. 100 crore in the first year itself on HPL could be either in the form of an actual amount of spending or commitment earmarked for expenditure in the project. On the export commitment of HPL, he said the project would stress more on the need to substitute imports rather than earning foreign exchange directly through exports.

"There is really no justification for exporting something which has to be imported by us. It would be better if expensive imports are substituted by domestic production and resort to exports if there is an exportable surplus".

Replying to shareholders' questions at the meeting, Mr. Seth said that Tata Tea was awaiting clearance from controller of Capital Issue (CCI) to go ahead with its unprecedented acquisition of Consolidated Coffee Limited. The company had already received clearance under the Monopolies and Restrictive Trade Practices (MRTP) and the Companies Acts. The CCI consent pertains to an issue of ordinary shares of aggregate face value of Rs. 2.10 crore to implement the takeover.

In a departure from normal proceedings at such meetings, the aggressive shareholders showered encomiums on Mr. Seth, calling him one of the most able corporate heads in the country. Quick to react to the emotional hook, the Chairman said Haldia held a special significance for him as it washed the feelings of injustice and alienation felt by the people of Bengal for long due to delays faced by the project. "It is our

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vehicle for bringing Haldia back to life", he added.

He said that Haldia would only do that part of the work which would not be possible for others. Citing an example, he said the project would allow cracker units to be made by the smaller producers and would not try to corner those areas simply because it made polypropylene. "In this manner, the social benefit of the project would be further multiplied".

Tata Tea's production of black tea during the first five months of 1990 fiscal stood at 25.41 million Kgs., two per cent lower than that in the previous year's corresponding period. However, the company's total income during the period was Rs. 108 crores 18% higher than the corresponding period last year. This meant, Mr. Seth said, that the results for the ongoing year would be better than that in 1989-90.

The meeting also passed resolution allowing Mr. D.N. Ghosh, Chairman of L and T to become a member of the board.

#### INCENTIVES FOR GAS-BASED UNITS IN TRIPURA

The Tripura government has finalised a new incentive scheme for industries to attract prospective entrepreneurs to set up modern gas-based units in the state.

The package of incentives, finalised at the cabinet meeting on Sept. 12th covered almost all areas to start a new project. The cabinet has decided to make available subsidies for the preparation study, rent for the land, factory sheds and development of the plot.

The government will provide financial assistance for the cost of high tension power line, setting up of captive power generating sets and subsidy on the consumption of power by the units. The package includes interest subsidy on

loans, and exemption from the stamp duties and registration fees.

The government has decided to exempt all new industrial units from sales tax for five years. It has announced price preference for the products manufactured locally and give priority for purchases. Besides the units would be exempted from depositing earnest money had security deposits.

Official sources said another survey was now being carried out to identify the types of units suitable in the state despite its geographical limitations.

#### 15 P.C. RISE IN FERTILISER INTAKE LIKELY

A quick analysis of the likely consumption of fertilisers during kharif 1990 indicates that there will be an increase of 15% over kharif 1989. The total consumption is estimated to grow at about 10% over kharif 1989. Tamil

Nadu and M. P. are anticipating an increase of 16% and 18% respectively over the kharif 1989 consumption.

Similarly, Rajasthan and Bihar are anticipating a growth of 15 per cent over kharif 1989. Madhya Pradesh and Gujarat are also anticipating a growth of 15 per cent.

Due to the widespread rains, additional area likely to be taken up for rabi sowing, and better support prices for different crops, the fertiliser industry, the States estimate a growth of about 9 to 10 per cent consumption in rabi 1990-91 over rabi 1989-90. The supply of fertilisers in small bags is being encouraged. Besides, the State Governments have been advised to increase the limit of stocks from 2 to 10 tonnes, to be held by dealers having no dealership registration certificate. The State Governments of Madhya Pradesh, Rajasthan, Uttar Pradesh and Orissa have already issued the exemption orders.

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## HALDIA PETROCHEMICALS PROJECT

### ICI-UK offers research help

ICI, UK has offered full research help from its technology park to the Haldia Petrochemicals project in West Bengal. Its rich experience in the field of chemicals can be an asset should the tie-up materialise. In a rare interview, Mr. George Hunter, the chief executive of ICI's Belasis Hall Technology Park, said that ICI would be only too happy to share with the Haldia authorities the company's high technology activity in the field of polymers at its specially designed laboratories and workshops at the technology park.

Mr. Hunter admitted that it would be somewhat of a long-distance help; but it was quite plausible should the Haldia authorities and ICI, India agree to contact ICI, UK. The Belasis Hall Technology Park at Billingham, near Newcastle has to tackle an industrial situation, strangely similar to that of West Bengal. The entire north-eastern region of UK had a flourishing industry in the 1950's in the traditional sectors of coal mining, steel making, engineering and ship building. During the sixties and seventies all these industries declined in the face of worldwide competition. The effort now is to modernise the industrial scene with the establishment of high-tech units. The ICI's technological park

plays a key role in the revival of the industrial scene of the area. The industrial aspirations of West Bengal are perhaps not very different.

Mr. Hunter admits that ICI's involvement in changing the trend in industry has a certain amount of penance. Hundreds lost jobs because of automation in the chemical industry of ICI. In the last 20 years, 7,000 people lost jobs in ICI. The prime motivation of the technology park is to create more jobs in the 21st century. The industrial base has been broadened to introduce biotechnology, electronics, information technology and not just chemicals, he added. ICI's experiment in the technology park — which is an improvement upon the science park — has proved highly successful. Set up as a joint venture with the English Estates north, it has already completed its first phase of work and has started upon its second phase four years ahead of schedule. 32 companies, with varied field of activities as biotechnology, chemical and engineering design, computer system analysis, PCB manufacture, rubber and plastics research, food technology, marketing consultancy are now taking the benefits from the expertise of the technology park. Now ICI is already ent-

ering into the third phase of industrial rejuvenation — the process plant pa-

Of the eight ICI locations in UK, Billingham factory is one of the oldest. Because of the improvements in processes and changes in the technologies at ICI, large areas of development land are now available for companies to set up their processing plants.

This would clearly reduce the capital cost of the companies to come up with a fully developed infrastructure.

They could avail of the wide range of chemical raw materials and intermediates, such as ammonia, methanol, acrylics, amines, alcohols, mineral acids, petrochemical and plastic intermediates and finished products.

### SAUDI ARABIA'S OIL OUTPUT SOARS

Saudi Arabia's oil production has shot up by two million barrels to reach over seven million barrels a day by way of compensating the shortage resulting from the embargo clamped on Iraqi and Kuwaiti oil, reports MENA-POOL.

Oil industry analysts believe that Saudi Arabia began to increase and store its oil production two or three weeks ago.

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## Oil find in Jaisalmer

The Oil India Ltd. (OIL) has found new reserves of oil and natural gas in the desert district of Jaisalmer.

Since the successful drilling of the first well near Tanot in August 1988, four more wells have been drilled with satisfactory results.

The fifth well near the Dandewela site has been the "most rewarding", so far, according to Mr. B.B. Sharma, General Manager, of the project.

Mr. Sharma said encouraged by the continued success of its exploratory endeavours, OIL had begun drilling the sixth well again near the Dandewela village on September 3.

Besides, oil and gas, the fifth well had huge reserves of hydrocarbon. The newly found deposits of oil, gas and hydrocarbon would prove to be a landmark in ushering a new era of industrial revolution in the desert district, which had hitherto remained industrially backward, he said.

On the achievements of the drilling operations, Mr. Sharma said the first well yielded some 45,000 cubic metres of gas per day, while the second well was pouring out 48,000 cum of gas everyday.

The outcome of the drillings conducted at the third and fourth wells were equally good. As compared to these, the fifth well was yielding 77,000 standard cum of gas per day.

The drilling of the fifth well had also revealed an estimated potential of 10 barrels of high quality crude oil per day, he said.

According to experts, the Dandewala, Tanot and Ramgarh belt has an estimated reserve of 25 lakhs cum of gas which could be exploited for more than 15 years. Mr. Sharma said OIL had proposed to Rajasthan State Electricity

Board to set up a 15-mw thermal power generation unit in Jaisalmer.

OIL India plans to lay a gas pipeline from Tanot to Ramgarh. If necessary, it could be extended upto Jaisalmer. It plans to drill 20 wells under its Rajasthan project during the Eighth Plan. For this, a provision of Rs. 185 crores had been made, he said.

The World Bank had also sanctioned a \$ 25-million loan assistance for the Rajasthan project.

### IOC SIGNS MoU

Indian Oil Corporation recently signed an MoU with the Government laying down the performance targets for 1990-91.

The corporation had been given a refinery crude throughput target of 23.65 million tonnes against the actual

target of 23.53 million tonnes in 1989-90. A target of Rs. 794.20-crore profit before interest, depreciation and tax had also been fixed. IOC was expected to mobilise resources for capital investment, without seeking budgetary support. The Government had also agreed to accord approval on a time-bound basis to the proposals of IOC for various projects. The MoU also provided for monitoring the physical progress of the various ongoing projects.

### NEW IIP DIRECTOR

Dr. T. S. Prasada Rao, the head of the Research and Development Centre of Indian Petrochemicals Corporation Ltd has taken over as the director of Indian Institute of Petroleum — country's premier national laboratory under CSIR.

Dr. Rao is an internationally acclaimed scientist with specialisation in the field of "catalysis".

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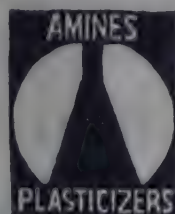
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**BARAJAMDA-ORISSA IRON ORE PROJECT****Rs. 1000 crores investment plan**

In an attempt to stop export of iron ore from the Bailadila mines, the steel ministry has proposed an investment of Rs. 1,000 crores for development of the Barajamda-Orissa sector as an alternative site from which ore exports can be undertaken.

The proposal assumes significance in the light of the controversy over exports from the Bailadila mines. The steel ministry is at loggerheads with the commerce ministry over the latter's initiative to export 6.5 million tonnes of ore every year from these mines. The steel ministry has stated that it will have no objections to export ore if it is done from the Barajamda-Orissa sector. The ministry is willing to support export levels of 34 million tonnes ore per annum or even more if the Minerals and Metals Trading Corporation of India Ltd. (MMTC) can develop and sell medium to high grade ore.

According to the ministry, the Barajamda-Orissa sector has the largest reserves of high grade ore in the country. The iron content is as high as 62 to 64 per cent and reserves are around 4,500 million tonnes. Therefore, it is this area that should be taken up for long term export contracts. These reserves, it is felt, can sustain export of ore per annum over and above the domestic demand.

The Rs. 100-crores investment programme includes an investment of Rs. 20 crore by way of assistance to mine owners to undertake systematic mining with washing facilities. An outlay of Rs. 250 crore is envisaged in developing new deposits with this sector. Additional investments of Rs. 500 crore is proposed in modernising and expanding port facilities to handle around six to eight million tonnes of ore traffic per annum. An additional investment of Rs. 250 crore

is proposed in completing the rail link between Banspani and Daitari which will provide the necessary transport infrastructure for exports. Meanwhile, the ministry has continued to insist that there will not be enough ore coming out of Bailadila mines to meet exports of 6.5 million tonnes per year. With domestic demand going up rapidly, the situation with regard to exportable surplus is already bad enough, but the scenario will be much worse five years from now.

It has been estimated that the proposed production of iron ore from Bailadila by 1994-95 will just about take care of domestic demand, leaving nothing or very little for exports. Total production five years from now is placed at round 14 million tonnes. The ministry has gallantly offered to allow export of the remaining ore after all domestic considerations are met.

But the export offer is merely a gesture. According to the steel ministry's projection, there will not be enough capacity with the railways to conduct exports out of Bailadila. It is claimed that the railways will have their hands full handling five million tonnes of ore earmarked for Visakhapatnam and 4.5 million tonnes for the sponge iron units.

Against this, railway carrying capacity will be around 12 million tonnes per annum and that too after completion of the Koraput-Rayagada sector in 1991-92. Clearly, in the ministry's estimate, even if surplus ore is available from Bailadila, there will be no infrastructure to transport it to ports.

**Bailadila ore export will hit mini steel units**

The government's move to export high grade iron ore from Bailadila on a long term basis to countries like Japan will be highly counter-productive, opposed to the new strategy of substan-

tially expanding sponge iron capacity and harmful to the mini steel industry according to Mr. Grewal, chairman of the Mini Steel Industry Association of India.

A press release issued by the association says that the tight foreign exchange position had to sever curtailment of ferrous scrap imports, the basic raw material for the mini steel industry. The sponge iron industry, which has been encouraged to come up to provide part substitute raw material to the mini steel plants, will be starved of its basic input high grade iron ore, and this in turn would adversely affect production of the mini steel plants which have been passing through difficulties due to want of raw materials.

The release says that the government itself is expecting the mini steel sector to double its production by the end of the Eighth Plan. The revised licensing policy enjoins on the newly set up mini steel plants to use increasing quantities of sponge iron upto 70 per cent.

High grade iron like that available in Bailadila has about 65 per cent iron content and would be required by the sponge iron plants which are expected to substantially increase production by the end of the Eighth Plan.

The diversion of large quantities of superior iron ore for exports may earn a small amount of foreign exchange in the short run, but will starve indigenous industries of their raw material requirements. Besides, it does not stand to reason that the country should continue to be shackled to the export of basic raw materials when value added items can fetch ten times the amount of foreign exchange.

The association has appealed to the commerce and steel ministry to have a fresh look on these proposals and take a pragmatic decision conducive to the interest of the steel industry with a long term perspective in view.

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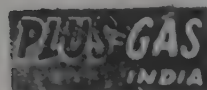
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## Titanium sponge plant to be set up

A decision to set up a mini-scale titanium sponge plant, with 1,000 tonne per annum capacity, has been taken by the empowered board for strategic minerals set up in the cabinet secretariat. This was stated by the secretary of the department of mines, Mr. P.K. Lahiri.

The plant, for which feasibility studies are currently on, will be jointly executed by the Department of Atomic Energy (DAE), the Defence Metallurgical Research Laboratory (DMRL), Hyderabad, and the department of mines.

According to Mr. Lahiri, the titanium facility is to be established in conjunction with the new zirconium sponge project of the DAE slated for the Eighth Plan period. This is apparently because the technologies for the sponge form of the two strategic metals have quite a lot in common. Although the country is abundant in titanium resources, in the form of ilmenite and rutile minerals, and setting up of mining and beneficiation facilities has been initiated, a fullscale metal production of facility does not exist. The country's requirement of titanium metal is being met entirely through imports of about 15,000 tonnes of titanium oxide, valued at about Rs. 30 crores.

Titanium is a light engineering non-ferrous metal with exceptional physical and chemical characteristics finding important use in aerospace and defence applications. In this context it may be pointed out that the USA, which does not have any worthwhile titanium resources, maintains a large stockpile of titanium sponge. In India, the mineral, ilmenite, is found in vast quantities in the coastal belts, notably in the beach sands of Kerala. Total reserves are of the order of 100 million tonnes of ilmenite and 8 million tonnes of rutile, constituting 15 per cent of world reserves.

Apart from mineral separation faci-

lity, large scale production facilities for synthetic rutile, titanium tetrachloride and pigment grade titanium dioxide are already in operation. Capacity for mill products for bars, sheet forgings, wires, heat exchangers, anodes etc. also exists at Midhani. Technology for equipment fabrication, like power plant condensers, however, needs augmentation.

Till recently, indigenous technology for metal production was also not available. But this has now been remedied by the technology for titanium sponge developed at the DMRL, which had taken up the project because of its extensive use in defence. It is this technology that will be implemented at the new facility that has been decided to be established.

At present the USSR tops titanium sponge production with an annual capacity of 45,000 tonnes. It is also interesting to note that while Japan has no titanium resources, it ranks second in production with a capacity of 35,000 TPA. The USA produces 32,000 TPA, followed by the UK and China, with about 5,000 TPA and 3,000 TPA respectively.

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### SELF-SUFFICIENCY IN MAGNESIUM ACHIEVED

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India has joined the exclusive club of magnesium producers. Imports of this critical item which is used in the atomic energy, aerospace and defence programmes as well as the aluminium, automobile and pharmaceutical industries, were gradually being phased out as the two manufacturing facilities in the south put increasing quantities in the market.

The first unit, Southern Magnesium and Chemicals Ltd., in Kovvur, Andhra Pradesh, went into commercial production in April this year followed two months later by the Tamil Nadu Industrial Development Corporation's project. Both plants have an installed

capacity of 600 tonnes per annum each which would comfortably take care of the country's requirements estimated between 800 and 1,000 tonnes. So far this has entailed an outflow of Rs. 10 crores to Rs. 15 crores but with magnesium being taken off the OGL list in June domestic production was expected to meet most of the commercial requirements.

Southern Magnesium, has been promoted by Dr. K. Bhanu Prasad, former energy secretary and ex-ONGC chairman, and the Andhra Pradesh Industrial Development Corporation. The Rs. 3.2 crore gas-based project has already supplied 95 tonnes valued at Rs. 1.2 crore to Balco, HAL, and DMRL.

Director N. Ram Prasad said that although a late development it was a matter of great satisfaction that India had joined a handful of developed countries in producing magnesium on a commercial scale. In fact, the technology has been available in the country for more than 15 years as the National Metallurgical Laboratory (NML) at Jamshedpur and the Central Electrochemical Research Institute (CERI) at Karaikudi had developed indigenous processes.

NML had gone a step further and put up a 200-tonne demonstration plant which was turning out magnesium in semi-commercial quantities. Ram Prasad said part of this plant was bought by his company in a tender, dismantled and set up in Kovvur with a number of modifications and an upgradation of its capacity to 600 tonnes. The raw material handling capacity at the project was equivalent to 1,200 tonnes but the company is not planning an expansion till it is well established.

While the Tamil Nadu project uses the CERI technology, Southern Magnesium has changed the production route from the original electrolytic process to the more economical pigeon process.

## ENERGY CONSERVATION

**Plan for massive media campaign**

Petroleum Conservation Research Association (PCRA) proposes to launch a massive media campaign soon involving a large section of population to make them aware of the need for energy conservation in the context of the changing international scenario. Mr. R.P. Mandal, deputy general manager, PCRA, said unless the conservation measures were stepped up the government might be forced to clamp restrictions on the use of petroleum products. Mr. Mandal was addressing a consumer meet for fuel oil consumers of Calcutta and suburbs organised by PCRA, eastern region.

By the turn of the century, the demand-supply gap of petroleum products in the country was expected to be in the region of 50 million tonnes. If the current price trend was any indication, the total oil import bill in 2000 A.D.

would be of the order of Rs. 20,000 crores against about Rs. 11,000 crores now. The scenario, therefore, called for a vigorous effort to conserve the use of fuel. An investment of Rs. 5,000 crores in energy conservation measures now, he indicated, could avoid an additional investment of Rs. 10,000 crores in the creation of additional facilities for energy production and distribution. The savings of petrol fuels achieved through PCRA's effort amounted to Rs. 200 crores, he said adding that energy studies revealed that there was ample scope for effective saving to the tune of 20 to 30 per cent in the use of energy in the industrial sector. Mr. A. Chatterjee, executive director, CESC Ltd., and member of the Energy Conservation Committee of Confederation of Engineering Industry, Eastern Region, said encouraged by CESC's experience with battery-driven car in the past one year,

CEIER was planning to moot a proposal with the government if similar vehicles with some modifications could be introduced at important metro railway centres to operate feeder services between the stations and nearby localities as were being done now by three wheelers which were not only oil guzzlers but also created a lot of pollution.

Mr. K.K. Rai, deputy general manager, Indian Oil Corporation, said the petroleum product consumption scenario in India indicated average annual growth rate of six to seven per cent between 1985-86 and 1990-91. During this period, the growth of total energy requirement had been from 741 MTCR (million tonne coal replacement) to 1025 MTCR.

The Indian petroleum scene was further affected by the steep rise in international crude price hike from \$15 to \$30 per barrel, hence the imperative need to conserve petrol fuel.

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# New coal-based tech. for power favoured

Energy experts have suggested a new coal-based technology — the integrated gasification combined cycle (IGCC) — as an efficient and environmentally safer alternative for power generation.

Unlike current technologies that generate power using pulverised coal, IGCC uses natural gas and coal gas as fuel. It is more efficient, environmentally safer, requires less land and water and is less capital-intensive than current methods based on pulverised coal, Dr. R.K. Iyengar, Additional Director General of the Council of Scientific and Industrial Research (CSIR), told a press conference at New Delhi on September 19.

Dr. Iyengar was summing up the deliberations of a three-day Indo-US workshop on "more efficient and environmentally benign power generation", organised by the CSIR, which concluded on September 19. Energy experts from the National Thermal Power Corporation (NTPC), Bharat Heavy Electricals Limited (BHEL) and other departments dealing with power, and delegates from the United States participated in the workshop.

In conventional thermal power plants, pulverised coal is burnt in boilers to generate steam, which in turn is used to drive a steam turbine and generate electricity.

These plants require large amounts of water, big investments and capital, and release harmful oxides of sulphur and nitrogen into the atmosphere. Besides, these plants, after decades of development and operational experience, have reached the maximum limit of attainable efficiency — about 35 per cent. In the new IGCC technology, power is first generated through steam turbines, which is further augmented by power generated through a gas turbine to achieve an overall thermal efficiency of 55-60 per cent. In this cycle, about 60 per cent of the power is generated

through the gas turbine and the remaining 40 per cent through steam turbine. Dr. Iyengar said, in addition to higher efficiencies, IGCC plants emit lesser particulate matter and sulphur oxides, require less water and land per unit of electrical output, and have a quick start-up and costs less for every kilowatt of power generated every year.

The IGCC has matured in many developed countries which have huge deposits of natural gas. The IGCC technology needs to be evaluated under Indian conditions as Indian coal has a high ash content (35 per cent) compared to coal in USA.

Since its supply is limited in India and it is required for steel plants and in the manufacture of chemicals and fertilisers, experts have suggested a long term strategy based on IGCC using coal gas only. The Bharat Heavy Electricals has already set up a Rs. 16 crore 6 megawatt IGCC plant at Trichy last year. The Trichy plant uses the moving bed gasification process, one of the several IGCC methods that can be adopted. A second IGCC method, the fluidised bed gasification process, has also been evaluated for its techno-economic feasibility under Indian conditions. In the moving bed process, coal and steam with oxygen are fed in a counter current flow, while in fluidised bed process, coal and steam with oxygen are fed either into the coal bed or under it.

## BOILER MAKERS SEEK FUNDS FOR MODERNISATION

Boiler manufacturers have urged the government to extend incentives to industrial units for replacing their outdated, fuel-guzzing and pollution-causing boilers with new and efficient ones. Addressing a news conference at Bombay recently, Mr. N.K. Desai, convener of Indian Boiler Manufacturers' Association (IBMA), said that prompt government steps in that direction

shortage being faced by the country as a result of the Gulf crisis.

Replying to a question, he said that ironically the large number of obsolete and inefficient boilers in the country, a conservative estimate, caused fuel wastage in the region of Rs. 648 crore a year, while it would cost only Rs. 30 crores for replacing all such old boilers with the new and efficient ones. Mr. B.S. Grover, chairman of the public relations committee of IBMA, said that the railway ministry was planning to do away with 4,000 boilers in its locomotives in five years. However, he feared that all these boilers would, instead of getting scrapped, be sold out and find use in various industrial units, thereby perpetuating inefficiency. Replying to a question, he clarified that 70 per cent of boilers in India were presently fuelled by coal and agro wastes, and the remaining 30 per cent by oil. He suggested that inefficient boilers should be replaced in a phased manner, at the rate of 20 per cent every year. Mr. R.N. Engineer, a boiler manufacturer, pleaded for earmarking adequate supply of good quality steel plates and tubes by steel plants to boiler units, which were forced to operate only at 50 per cent of their installed capacity owing to raw material scarcity.

## TWO NUCLEAR PLANTS FOR AP

Two nuclear power plants, one at Nagarjunasagar project area and another at Srikakulam district, will be set in Andhra Pradesh after consulting the eminent scientist Dr. P.K. Iyengar, Chief Minister Dr. Chenna Reddy said recently. Talking to newsmen at Lingala, about 30 km. from Machilipatnam, he said the state government would consider allowing even the private sector to take up major projects. Dr. Reddy said the state government had allocated Rs. 440 crores for improvement of power generation in Andhra Pradesh. At present the power generation capacity in the state was 3995 MW, and it would

## Company Notes

### KHATAU JUNKER

Khatau Junker Ltd. has performed well in its silver jubilee year ended March 31, 1990, with turnover touching Rs. 16.52 crores from Rs. 10.79 crores in the previous 15-month period registering a growth of 91.4 per cent on an annualised basis.

The net profit after tax has tripled on an annualised basis at Rs. 77.62 lakhs as compared to Rs. 30.85 lakhs for the previous 15 months. The company has also declared a dividend of 25 per cent (including 5 per cent silver jubilee dividend) as compared to 12 per cent (annualised) during the previous working period.

Addressing shareholders at the 25th annual general meeting, Mr. Dilip Khatau, Chairman, said that the agrochemicals division of the company had made rapid progress. The year 1990 witnessed the introduction of two more products phosphamidon and DDVP. These were developed with in-house technology and had received an excellent response from the market.

The company has also successfully launched a wide spectrum of agrochemical formulations throughout the country and has commissioned its upgraded monocrotophos plant with a capacity of 600 tonnes per annum recently. Khatau Junker is also modernising its existing malathion and dimethoate plant which will enable it to introduce new products like chlorpyrifos, glyphosate, ethion, etc.

The outlook for the current year is bright, and, during the first five months, the company has achieved a turnover Rs. 10.26 crores as compared to Rs. 6.47 crores in the corresponding period of the previous year, recording an impressive growth rate of 59 per cent. The company is also venturing into the production and marketing of high

quality hybrid seeds for various commercial crops and vegetables. The seeds that will be marketed will be backed by substantial research and development efforts and overseas know-how.

To part finance the expenditure envisaged on the above modernisation and diversification, the company proposes to issue 14 per cent secured, fully convertible debentures for an aggregate value not exceeding Rs. 15 crores. An application to the CCI for the same is to be made at an early date.

### AEGIS CHEMICAL

The operating profit of Aegis Chemical Industries has dropped to Rs. 383 lakhs during the 18-month period ended March 1990 from Rs. 395 lakhs in the previous year despite an increase in turnover to Rs. 36.38 crores from Rs. 22.29 crores last year.

The decline in profit was due to the closure of its Dombivli unit for eight months. After interest charges of Rs. 317 lakhs and depreciation of Rs. 190 lakhs, its loss works out to Rs. 190 lakhs.

### CEPHAM ORGANICS

The board of directors of Cepham Organics Limited has recommended a 16 per cent dividend for the year 1989-90. The company has achieved a turnover of Rs. 1,296 lakhs (Rs. 735 lakhs for nine-months) and the profit works out to be Rs. 41 lakhs (Rs. 19.15 lakhs, nine months).

The company has exported goods worth Rs. 71 lakhs in the first-two months — February-March 1990.

The company is implementing a project for the manufacture of semi-synthetic sterile product for sale in the domestic market under the newly formed company, Rajasthan Antibiotics Limited at Bhiwadi, at a cost of Rs. 715

lakhs. The project would go on stream in May 1991.

### HOECHST INDIA LTD

Sales of Hoechst India for the year ended 31 March 1990 amounted Rs. 262.4 crores, recording a growth of 34 per cent over the previous period on an annualised basis. The increase in turnover has come from increased sales of both pharmaceutical products and agrochemical activities.

Addressing the 34th annual general meeting, Mr. Vijay Mallya, chairman, told shareholders that despite an increase in turnover, profitability for the year came primarily from exports and agrochemical activities.

He said the company like many other drug firms, had received notices from the government demanding payment of a large sum into the Drug Prices Equalisation Account. The company submitted representations explaining that since during 1981-87 the company made a loss of Rs. 2.5 crores in its domestic pharmaceutical business, the question of unintended profits do not apply. Despite this, Hoechst deposited Rs. 3.12 crore with the government, without prejudice to its contention, in order to demonstrate its bonafides. This was its full and final liability as determined by the government's special team and price review committee. Notwithstanding all these facts, government sent a notice demanding Rs. 24.91 crores under DPEA. This forced the company to file a writ petition, Mr. Mallya said.

### SHIVALIK FERTILISERS

Shivalik Fertilisers Ltd., a company of the Aima group of industries, has entered into an agreement with National Fertilisers Ltd., for the marketing of NFL urea in the entire State of Punjab. This is the first time an SSP company has taken up such an arrangement. The established and extensive distribution network of Shivalik in Punjab and the

tremendous goodwill enjoyed by its SSP were the main considerations for NFL to assign this responsibility to Shivalik.

The sales of NFL urea by Shivalik has already commenced in May 1990 and a turnover of Rs. 295 lakhs has been recorded in four months. The company hopes to market 50,000 tonnes of urea in the entire year.

The company has also achieved significant improvement in its performance. The net profit has been Rs. 72.93 lakhs for the five month period (April-August 1990) which is expected to be Rs. 198 lakhs for the entire year. This will result in an impressive EPS of Rs. 8.03, up from Rs. 3.27 in 1989-90.

This has been mainly due to increase in capacity utilisation from 71 per cent to 91 per cent in the case of SSP and from 68 per cent to 95 per cent in the case of sulphuric acid.

The company produced 51,995 tonnes of sulphuric acid in the five month period of the preceding year. In the first five months of the current year, the company has reported a sales turnover of Rs. 1,550 lakhs, which is 50 per cent higher than Rs. 1109 lakhs for the pro-rata five month period of 1989-90.

The turnover for the full current year is estimated at Rs. 4,200 lakhs which will mean an impressive increase of 58 per cent over the previous year.

## INDIAN DYESTUFF

Indian Dyestuff Industries (IDI) proposes to set up a 100 per cent export oriented unit for the production of copper phthalocyanines crude (CPC) in collaboration with Enimont group of Italy. For that purpose, a new company will be formed wherein IDI's participation will be to the extent of 35 per cent of the capital and 65 per cent will be held by Enimont group.

Baroda. The project work is expected to start in the last quarter of 1990. The plant will have an initial capacity of 2,000 tonnes and will be increased to 4,000 tonnes in the course of three to four years. The company expects to commission the plant by the end of 1992.

The main raw material for the manufacture of CPC is phthalic anhydride which is available from the Baroda unit. This will help the company to have better utilisation of capacity.

IDI has been granted a letter of intent for manufacture of 800 tonnes per annum of agrochemicals, namely, monocrotophos and phosphamidon of its Boisar plant.

The raw materials for the manufacture of these agrochemicals, viz. Alkylamides, are presently manufactured at Boisar plant.

The implementation of the project will take about three years and the total cost of the project is estimated at Rs. 7.25 crores, which will be financed out of the internal accruals and borrowings from financial institutions.

## INDROL LUBRICANTS

Indrol Lubricants & Specialities Ltd. is changing the company name to Castrol India Ltd. The board feels that the change of name will be beneficial to the company's business and reflects the confidence of Castrol UK in its operations.

The directors have recommended maintaining the dividend at 27 per cent for the nine month period ended 31 March 1990, which works out to 36 per cent on annualised basis. The company has also recommended issue of bonus shares in the ratio of three bonus shares for every five equity shares held.

The management has initiated cost

the results in the new year.

## ORGANIC CHEMOILS

Organic Chemoils Limited (OCL) has further secured its future prospects with higher capacity utilisation in all its plants. The company has also entered into a 5-year lease agreement with Hindustan Lever limited (HLL) for its soap making plant, effective from 1 July 1990.

The company is well established now and is operating its plants at 80 to 90 per cent of installed capacity. Considering the increased market needs, the company is planning to enhance its fatty acid distillation capacity from 50 tonnes per day to 100 tonnes per day in the current year itself.

The company achieved a turnover of Rs. 22.93 crores in the year ending March, 1990, registering a 30 per cent increase over the annualised sales of the previous year. The company has earned cash accruals to the tune of Rs. 137.7 lakhs. The company hopes to increase its sales in the current year to Rs. 30 crores.

## CHEMICAL SPECIALITIES

Chemical Specialities (India) Pvt. Ltd., a Madras based company, has set up a unit at Sholinganallur in Tamil Nadu with an investment of Rs. 200 lakhs.

The plant will manufacture a wide range of speciality paints for industrial as well as for domestic applications. Marine paints and high quality synthetic enamels and plastic resins will also be manufactured.

The company has a technical tie-up with Lever Sutter of West Germany for producing the entire range of highly advanced electroplating chemicals. The company expects a turnover of Rs. 15 crores during 1990-91. It is planning to diversify in the field of

# Highlights in Chemical Technology (Part I)

## IMPACT OF CATALYST RESEARCH ON POLYOLEFIN TECHNOLOGY

Dr. William Bowles, process research director for Quantum Chemical Corp (USA) (world leader in polyolefin technology) recently reviewed the role of catalyst research in polyolefin technology.

According to Dr. Bowles in the 1990 improved catalyst technology will take the industry to new heights in polyolefin processing and properties. Also polyolefin properties in future will be significantly enhanced through new technology developed for copolymerization, alloying and blending.

The new catalysis will allow resin manufacturers to significantly increase output of existing reactors and improve on the quality of resins that can be made in these plants.

The impact of catalyst research on polyolefin technology can be judged by the following data on the output per pound of catalyst.

'Thirty years ago, the industry got 15 pounds of polymer out of a pound of catalyst. Today, it gets over 10,000 pounds of polymer from a pound of catalyst. In future, a further 5 to 10 fold increase is expected via catalyst research. Further, Dr. Bowles foresees that new catalysts will allow suppliers to offer polyolefins having much higher levels of performance, that is, permit them to become engineering grade materials. Tailoring of molecular structure is a real possibility in the 1990s. This will allow resin manufacturers to zero in on specific customer needs, Dr. Bowles predicts. He sees the emergence during the decade of new engineering plastics based on ethylene and propylene, which will be more cost-effective than the benzene based engineering plastics that have dominated the last two

decades'. Some new ideas are emerging from studies done in 1960s with polar copolymers. However, at that time market needs were such that not enough interest was generated to make them commercial products. Now, they are being re-evaluated at Quantum Chemical Corporation for use in recycling, alloying and environmental protection.

There is also a worldwide resurgence of technical interest in high-pressure polyolefins. For example, Quantum is encountering more interest in high-pressure polyethylene in their licensing activities now than ever before. In the 1970s, it was felt that low-pressure reactors were inherently cheaper to run and that they made products that would replace high-pressure reactor products, but that has not proved to be the case.

High pressure products still have advantages in processability and certainly in clarity. Further, high pressure reactors offer a versatility with copolymers beyond what low pressure reactors can provide.

Copolymers such as vinyl acetates, n-butyl acrylates, acrylic acid and carbon monoxide can be combined with ethylene in the high-pressure process, Dr. Bowles explains. Further, ionomers are not likely to be replaced by linear low polyethylene any time soon, according to Dr. Bowles. (CMR 5/28/90 pp. 5, 44).

## A NEW PROCESS FOR RECYCLING WASTES FROM PULP & PAPER INDUSTRY TO BE COMMERCIALIZED WORLDWIDE

Allied Signal (Morristown N.J.) and Ahlstrom Machinery Group of Finland will market jointly a new process for the treatment of wastes from pulp and paper manufacturing. The bipolar membrane process developed by Allied Signal's Aquatech Systems business unit, recycles chemicals used in paper manufac-

ture. Sodium sulfate, a by-product of manufacturing process, is separated in its component acid and base chemicals and reacted in the membrane system to form caustic soda and sulfuric acid which can then be reused.

The process is reported to provide significant environmental and economic benefits for industry. Ahlstrom will market and construct systems worldwide with exclusive rights in Europe. (& EN 6/4/90, p. 7).

## NEW, NATURALLY DEGRADABLE POLYMERIC MATERIALS EMERGING

For decades, the plastics industry has worked on formulating materials that are durable, long-lasting and resistant to environmental factors. However, as use of plastics became very extensive, so too have concerns about their disposal. This has led to the development of degradable polymeric materials in recent years.

Whereas most high molecular weight synthetic polymers are resistant to biodegradation, materials based on naturally occurring polymers of starch, cellulose, lactic acid or proteins, or others produced by bacteria through fermentation processes can be readily biodegraded. As advances are made in production and processing, biodegradable plastics are likely to move toward new materials based entirely on naturally degradable polymeric materials.

Recently, a few firms have begun commercializing such materials abroad, particularly in USA the world's largest producer of plastics. Warner K. Lambert has established new environmental polymers division to commercialize its company's technology for a starch-based polymer it calls Novon.

The technology for processing starch was discovered when trying to find

new method to produce pharmaceutical capsules. Under certain conditions, contrary to what was generally believed, it was found that starch could be combined with water and injection molded without decomposing.

Novon was found to have a morphology that is different from normal starch and in its pure form has physical properties somewhat like crystalline polystyrene. By modifying it with just a small amount (up to 15 to 20%) of other materials one can get a broad range of properties. The other materials are proprietary in nature and the company does not divulge their nature except that they are biodegradable also.

Montedison (Italy) is another company, which has formed a new division called Novamont, to market a series of thermoplastic starch resins that are alloys of cornstarch and selected synthetic resins with up to 60% starch and starch derivatives. The remaining material is atoxic and of low molecular weight, which is expected to contribute to its biodegradability. Unlike the usual mixtures of starch and synthetic resins explains Montedison, the materials have an interpenetrating, stabilizing network, which is homogenous on the molecule level. The materials have properties similar to low density polyethylene and can be processed by most existing methods.

The company's first plant will begin operating in July 1990 with production of 5 million lbs per annum of biodegradable plastic.

ICI Biological Products, a division of ICI (UK) is launching a biodegradable polymer, polyhydroxybutyrate-polyhydroxyvalerate (PHBV). This product is a spin-off from the company's research started 15 years ago for developing a polymer based or naturally occurring raw materials at the time of first oil shortage. The company's researchers found that by adding organic acids to a sugar feedstock, the bacterium *Alcaligenes eutrophus*, which produ-

ces polyhydroxybutyrate naturally as an energy reserve will produce random PHBV copolymers. PHBV which is more processable than PHB and reported to be most like polypropylene, can be injection molded and made into films with conventional plastic processing equipment.

ICI sees it as a candidate where the end-use article is going to be flushable or thrown away. The material is readily degraded by microorganisms in soil or water. The material made from PHBV might be expected to degrade within a few weeks.

ICI and several other companies round the world are looking toward using biodegradable and environmentally benign additives or pigments with the biodegradable polymers. Thus, these 'bioplastics' and their by-products, which are degraded by microorganisms into carbon dioxide and water under aerobic conditions or into methane and water under anaerobic conditions tend to raise fewer concerns about their environmental fate. In addition, being based on renewable resources, such as starch or sugar avoids the use of limited petroleum resources. (*C & EN* 6/25/90, pp. 12-13).

#### **WORLD'S TINIEST SILICON PUMP BASED ON ETCHING TECHNOLOGY MAKES A DEBUT IN GERMANY**

A tiny pump, which is made entirely from silicon and with a volume of only three million of a litre, is the latest achievement of the field of micromachining which uses etching technology taken from the semi-conductor industry. The device has no moving parts, so should be resistant to wear and highly reliable.

A team at the Fraunhofer Institute for Solid State Technology, in Munich (West Germany), produced the pump which can shift 20 bls. of fluid a minute. It could be used in alcohol based systems for electronic components.

The device exploits the so called electrohydrodynamic principle, by which a voltage applied across a pair of electrodes submerged in a dielectric, or non-conducting fluid causes tiny drops of the fluid to rise up one of the electrodes.

The pump's electrodes consist of a gride of silicon crystals 9 mm square laid down as an array of orifices each 70 micrometres across. The pump is submerged in a polar fluid (one which contains ions of dipoles) and a voltage of around 100 volts applied across the two grides.

The liquid is forced between the gride by interaction of the electric field produced by the applied voltage with the field of the ions in the fluid. (*New Sci.* 6/2/90, p. 34).

#### **CERSA, UOP OFFER NEW LAB TECHNOLOGY**

Companie Espanola de Petroles (Cepsa) and US based UOP are offering their new process technology for the manufacture of linear alkyl benzene (LAB) for licensing.

The new process produces LAB by the alkylation of linear olefins with benzene over a solid heterogenous catalyst.

The two companies have joined forces to take advantage of UOP's expertise in engineering design, scale-up and licensing and Cepsa's experience in LAB production. UOP will be responsible for worldwide marketing of the new process.

Advantages of the new technology are that it has significantly lower investment cost than existing ones based on HF and  $AlCl_3$  catalyzed processes.

Also, it uses a non-corrosive catalyst, thus eliminating the special handling and recovery requirements inherent in the older processes. (*ECN*, 4/30/90, *ECN* 7/16/90, p. 34).

## A PATENTED CLOCK REACTION DESTROYS HYPOCHLORITE BLEACH

A clock reaction that destroys hypochlorite bleach quickly at a preset time has gained a patent (US Pat 4,908, 215) for senior biology research scientist Daniel Perlman of Branders University, Waltham, Mass. The reaction with thiosulfate produces nontoxic sulfates and chlorides and thus may find use in sprays or washes used to sterilize food and drug manufacturing equipment and surfaces.

Such sprays may also kill fungus or bleach out discoloration on house shingles without persisting to damage paint, metal fixtures or shrubbery. A commercial product based on the reaction might consist of two solutions that would be mixed before use — one of 50 ppm to 5% sodium hypochlorite and other of sodium thiosulfate and sodium dihydrogen phosphate. Destruction of hypochlorite is slow at high pH but generates acid, that decreases the pH. Then, when the pH reaches a lower level, the destruction reaction is fast and autocatalytic. Pre-setting initial pH at various high values, users can preset delay times for hypochlorite destruction from minutes to hours. (*C & EN* 6/4/90, p. 31).

## A NEW THERMALLY EFFICIENT ALTERNATIVE MELTER PROCESS UNDER DEVELOPMENT IN USA

Air Products & Chemicals Inc, (Allentown, Pa, USA) is seeking partnerships with glass producers to develop and field test a new oxy-fuel based glass melting process that is said to offer low nitrous oxide ( $\text{NO}_x$ ) emissions without increasing product cost.

The company is developing a melting process under an R & D programme, 'Thermally Efficient Alternative Melter' (TEAM), funded by the company and the US Dept. of

Energy (DDE). Air Products researchers will work closely with TEAM industry partners to understand their problems in developing heat recovery schemes, seek their help with computer modeling of the process routes and the design of heat recovery systems or furnaces and help implement the new melting process for testing at the partners' manufacturing sites.

The overall programme goal is to increase the international competitiveness of America's glass making industry through improved process economics and increased energy efficiency.

The objectives are to reduce energy consumption by 20% reduce  $\text{NO}_x$  levels to below 4 lbs per ton of glass and lower capital and operating costs below those of competitive melters.

With oxy-fuel firing, Air Products expects to eliminate regenerators and move to a direct fired design. Heat recovery on oxy-fuel flue gases will be more efficient, it says because of flue gas volume.

Another benefit of the TEAM process, according to Air Products will be enhanced radiative heat transfer with oxy-fuel firing, which it says may allow glass makers to melt new glass compositions as they evolve to meet specific customer needs. (*Glass Ind.* 7/1990, p. 6).

## A SUPERIOR POLISH TECHNOLOGY FOR BISPHENOL A TO BE COMMERCIALISED IN USA

A.B.B. Lummus Crest Inc will market biophenol-A technology from the Institute for Heavy Organic synthesis, a Polish Government Organization.

The Polish route is a continuous process using the environmentally preferred ion-exchange catalysed reaction system. A two stage reactor system works at mild conditions, resulting in

high bisphenol-A yields and low isomer content. (*CMR* 4/9/90, P. 9).

## A NEW BLEACHING PROCESS FOR PULP & PAPER INDUSTRY BASED ON OZONE TO BE COMMERCIALIZED IN USA

As part of a \$ 156 million modernization of its Franklin VA Pulp & Paper facility, Union Camp (Wayne, N.J.) is planning to install a new technology that uses ozone to replace chlorine in the bleaching sequence. The switch is aimed at cutting the generation of chlorinated organics including dioxin and reducing the colour and quantity of waste water.

Union Camp reports use of the technology at its Virginia unit will be the first full scale commercial installation of the bleaching process. Startup scheduled for second half of 1991. (*Chem Wk* July 4/11/1990, p. 49).

## A NEW PROCESS FOR FABRICATING BULK SUPER CONDUCTORS

The capability for manufacturing superconducting cables with high current capacity at liquid nitrogen temperature is still a long way off. But researchers at the Univ of Houston have moved closer toward this goal by developing a continuous process for fabricating large bulk samples of high temperature superconductors with reasonably high current densities.

Researchers at Houston have produced a 5 cm long bar of the 1, 2, 3 superconductor  $\text{YBaCuO}_7$  with excellent grain alignment throughout. The bar has a transport critical current density at 77K of 20,000 amp per square cm. in zero magnetic field and 7,500 amp per square cm. at 10.83 tesla.

This is comparable to the best results so far obtained in much smaller but similarly processed samples. The continuous growth is accomplished by

moving the sintered precursor through a hot zone in a furnace, thus encouraging directional solidification. The process is slow, but researchers foresee improvements leading to fast production of rods, wires, and other shapes. (*Nature* 345, 326, (1990)).

## CLEAN COAL PROCESS IN USA PASSES FIRST ENVIRONMENTAL TESTS

The Clean Coal Technology Programme has produced its first significant environmental results, according to the Dept. of Energy (DDE) of USA. At Lorraine, Ohio, power plant burning high sulfur coal, full scale tests of the 'Collside' process showed the process could operate continuously up to 11 days and reduce sulfur emissions 40 to 70%. In the process, hydrated lime powder and then water droplets are sprayed into combustion gases after they leave the coal boiler. The process yields a dry waste product that can be captured

by existing particulate collection devices, rather than the sludge typical of wet scrubbers. By using existing equipment rather than add-on scrubbers, the method can reduce the costs of pollution control at existing plants 30% or more, DDE reports. (*C & EN* 4/30/90, p. 26).

## POLYBENZOBISOXAZOLE (PBZ)- A NEW FAMILY OF ULTRA HIGH PERFORMANCE POLYMERIC FIBRE

The first demonstration plant for the production of the family of ultra high performance polymers known as polybenzobisoxazole (PBZ) has gone into limited production according to Comm-Tech International (Menlo Park, Calif) owner of the patents covering PBZ technology.

Published test reports based on the fibre produced at this plant show tensile and stiffness that are higher than

those of other polymers, steel and other metals and comparable to carbon fibre.

PBZ is a family of extended chain liquid-crystallising polymers, or 'rod' polymers that combine high strength and stiffness together with resistance to high temperatures, oxidation, moisture and U-V radiation.

The PBZ fibres will be embedded in resins to provide high-strength, lightweight composites for use in air and rail transportation equipment and mechanical and electrical devices.

The material was developed after more than 10 years of research sponsored by the US Air Force at SRI International. Comm-Tech International acquired the rights to PBZ from SRI. Dow Chemical holds the exclusive manufacturing rights to PBZ in the Western Hemisphere. (*Chem Eng* 7/1990, p. 38).








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# Food & Pharmaceutical Technology in Perspective

## AQUACULTURE POISED FOR GROWTH IN THE USSR

Aquaculture production in the USSR is set to expand dramatically by the year 2,010 to reach an annual output of 1.2 million tonnes. Species targeted for development under the new scheme include salmon (96,000 tonnes to be produced in 20 years' time), sturgeon (15,000 tonnes), other sea fish (80,000 tonnes) and mussels (50,000 tonnes).

There are currently 41 salmon rearing stations in the USSR, 23 of these located in the Far East of the country and the remainder in the White Sea, the Barents Sea and the Baltic. In addition there are 11 sturgeon farms producing about 120 million alevins per year, situated in the Black Sea, the Caspian and the Sea of 'Azov'.

Production at present, is primarily based on marina aquaculture, using sea cages, or the use of hatching stations to boost the natural reproduction of stocks. Production in enclosed fish farms have fallen short due to disease, shortage of artificial feed and limited equipment resources. Pollution is also hampering aquaculture development in the Soviet Union. (*Animal Pharm* 7/6/90, p. 12).

## CERTIFYING STERILITY OF FOOD VIA SPECIFIC CHEMICAL MARKERS PRODUCED WITHIN FOOD

Chemical markers produced when foods are heated can be used to establish the sterility of processed foods. An American researcher Hiejoon Kim has recently discovered as yet an unidentified substance, said these markers can provide noninvasive indicators of thermal treatment. Kim anticipates they will be used to verify sterility at the centre of food particulates that have undergone

aseptic processing. Industrial thermal processing of foods has been primarily a batch process ever since Frenchman Nicolas Appert invented canning in 1809. However, that situation is changing with the introduction of aseptic processing, in which fluid foods are sterilized as they flow through heated tubes (130 to 150°C) and are then packaged in sterilized containers. Thus continuous process is now widely used abroad in advanced countries for drinks and semi-liquid foods.

Thermophilic bacteria have been as bioindicators of sterility in aseptic processing. However, this microbiological approach is tedious and subject to experimental uncertainties. It is difficult to assess over processing because once an entire microbial population has been destroyed, one can estimate only a minimum lethality.

Monitoring chemical changes within the food is yet another innovative way to measure integrated time-temperature exposures at various locations within the food. Little research has been done in this direction. Therefore, the research group under Hiejoon Kim believes that the approach could be a useful one. They have discovered specific chemical markers whose concentrations would reflect time temperature exposures. To be useful chemical markers should meet several requirements. For example, the chemical reaction that produce them should be intrinsic to the foods. For more reliable analytical results, the marker should be thermally produced rather than thermally destroyed. It should be easily detectable and the method used to detect it should be sensitive. The marker should be stable toward oxidations or enzymatic reactions, which could lead to inconsistent results. It should be common to many foods. Further, it should be a time temperature integrator, rather than a

maximum temperature integrator because microbiological lethality. For a function incremental lethality at different time-temperature exposures.

The reaction rate should follow first order kinetics, since the thermal death of microorganisms is also a first order process. Finally, the marker concentration should correspond with  $F_0$  in such a way that one could verify the latter from the former.

Various chromatographic techniques and detection methods are useful for detective compounds in foods. Since organic acids and carbohydrates represent important classes of compounds in foods, the researchers decided to use anion exclusion chromatography (AEC) to reveal thermally induced changes in the profiles of those compounds. They also chose a general detection method — a photodiode array (PDA) sensitive in the U-V region, with scanning capability.

With that set-up, U-V absorption spectra of compounds eluting from the chromatographic column can be obtained several times a second, stored in a computer and manipulated for display. The three dimensional nature of the anion exclusion chromatography-photodiode array (AEC-PDA) system makes it useful for discerning new compounds produced by heating. Using the AEC-PDA method to analyze aqueous extracts of heated foods has so far revealed two thermally produced compounds that could be used as intrinsic chemical markers for high temperature/short-time processing of particulate foods. One compound, M-1 was produced upon heating a broccoli extract. The compound showed a chromatographic retention time of about four minutes, a characteristic U-V absorption of maximum at 300 nm and molecular weight as determined by gel filtration

chromatography of about 280. The compound was undetected in unheated samples. Its concentration increased steadily with increasing heat treatment. Most significantly, the concentration correlated well with the sterility value  $F_0$ , over a wide range.

The same peak was observed in a variety of other foods, including potatoes, green beans, carrots, orange, apples, beef and chicken. In the case of meats, there was an interfering peak with a slightly shorter retention time and lower peak wavelength. The Kim research group has also discerned another marker M-2, in heated meats, with a U-V maximum at 285 nm and an estimated molecular weight of 290.

The researchers are in the process of applying for a patent on the technique of using intrinsic chemical markers for validating thermal processes in particular foods. (*C & EN* 5/21/90, pp. 39-43).

### A GOOD ANTIDOTE TO AFLATOXIN ON THE HORIZON FROM USDA RESEARCH

Recent research in USA has shown that a compound hydrated sodium calcium aluminosilicate (HSCAS) used to prevent caking in animal feed may reduce levels of aflatoxin in the milk of animals eating grains contaminated with aflatoxin.

Aflatoxin is a naturally occurring toxic substance produced by several species of *Aspergillus* mold that infect seeds and nuts on growing plants and in storage. Very high levels of aflatoxin can cause acute poisoning and may cause liver cancer in humans. In USA, there are stringent safeguard against aflatoxin to maintain purity of foods. For example, milk carries FDA's most stringent aflatoxin limit — no more than 0.5 ppb.

American researchers at the USDA's agricultural research service station at Texas A. & M. University, have tested

cate (HSCAS) against aflatoxin in dairy cows, dairy goats, chickens, pigs, sheep and turkey. In one test, three dairy cows ate feed with 200 ppb of aflatoxin and aflatoxin levels in their milk were measured. The cows then were fed a diet including both aflatoxin and 0.5 per cent HSCAS. Aflatoxin levels in the cow's milk dropped 20 to 40% — from the measured 1.0 down to 0.8 ppb in one cow, from 2.1 ppb to 1.1 ppb — in the second cow and from 2.6 ppb to 1.87 ppb in the third cow. According to researchers the 200 ppb of aflatoxin used in the test was higher than cows realistically are likely to encounter. In USA, federal regulations limit aflatoxin levels in mixed feeds for dairy cattle to no more than 20 ppb. However, other parts of the world do not have such stringent legal limits for aflatoxin. Therefore, the above findings regarding the usefulness of HSCAS against high levels of aflatoxin could have worldwide implications in helping ensure a wholesome supply of dairy products.

More extensive tests are under progress but the findings are significant, particularly since this is one of the rare instance when you find an antidote that appears to be specific for a single toxin. According to researchers the HSCAS appears to bind aflatoxin in the animals' intestinal tracts, so the toxin passes harmlessly through their bodies.

The USDA describes HSCAS as a hopeful beginning in the development of a new technology that will make possible practical aflatoxin control methods for producers. (*CMR* 4/15/90, P. 23).

### RESEARCHERS PUSH FORWARD THE DEVELOPMENT OF ENZYME LIKE CATALYSTS

As part of the long-term scientific effort to design and synthesize catalysts that resemble natural enzymes, scientists from the Univ of Colorado, Medical School, (Denver) report the design

researchers based the protein design on the digestive enzyme chymotrypsin. They built a 75-amino acid structure from a functional 'triad' of three amino acids found in the enzyme, using computer aided design techniques. When they synthesized the relatively simple design, they found it reached the same way and with the same specific target molecules as the natural enzyme. (*C & EN* Wk July 4/1990, p. 496).

### ANTI-BACTERIAL FACTORS IN NATURAL HONEY ISOLATED

Researchers working under K. Russell have isolated and identified anti-bacterial constituents in New Zealand's natural 'Mannka' honey.

They are:

- (a) Methyl syringate
- (b) Methyl 3,4,5 trimethoxy benzoic acid and its methyl ester.

The above active agents, having anti-bacterial properties were isolated using combined gas chromatography and mass spectroscopy. Tests showed the acids and methyl syringate to possess significant anti-bacterial activity. (*Agric & Food Chem* 38 10-3, 1990).

### THE GEOGRAPHY & CHEMISTRY BEHIND COCOA BUTTER HARDNESS

American researchers, S. Chansins and P.S. Dimick have examined analytically over 60 cocoa butters from different geographic regions of the world for their glyceride content and hardness.

Soft cocoa butters were characterized by high POO and SOO contents (P = palmitic acid, S = stearic acid and O = oleic acid), while the hard cocoa butter had less POO and SOO.

South American cocoa butters were generally the softest and those from Asia and Oceania the hardest, with cocoa butters from North and Central

## MUTANT MICROBES REGISTER STRONG IMPACT ON CHEESE MARKET IN WESTERN EUROPE

Pfizer (USA) has received the first US approval to market a food product produced through genetic engineering. Cheese is one such product. Cheese production has jumped by leaps and bounds in both North America and Western Europe, indicating improvement in living as well as nutrition standards.

The US Food & Drug Administration has given the go ahead to the company's version of the rennin enzymes, which is used in cheese production.

The decision will give Pfizer's rivals something to be cheesed off about. The Dutch firm Gist Brocades has been selling its genetically derived rennin enzyme in Europe since 1988 when it received approval in Switzerland. It has since been allowed in several European countries, including the UK. The company also expects imminent FDA approval for its product but meanwhile Pfizer will be able to cream off the US market.

Rennin, also called chymosine, is a milk coagulant traditionally extracted from calves' stomachs. Both Pfizer's and Gist Brocades' Enzymes are derived from genetically engineered bacteria. The two firms do differ, however, in the type of bacteria they are using for the production process. Gist Brocades has cloned the rennin genes into *Kluyveromyces lactis* bacteria, which are already present in dairy products. But Pfizer is using *E. Coli* K-12 instead.

Gist Brocades said that it was loth to use *E. Coli* as it is a much less friendly bacteria than *Kluyveromyces lactis*. Pfizer, however, says that K-12 is one of the safest and most widely known bacteria in this area. The only other country, which has already approved

Pfizer's rennin is Australia. In the USA, the FDA took 29 months to approve the product. One of the areas it reportedly investigated was the possibility of impurities resulting from the use of K-12. The FDA also looked at environmental implications and at the rate of coagulation with the much purer genetically derived product.

The world market for rennin is worth over £100 million, but prices are traditionally unstable depending on the availability of calves' stomachs. The genetically derived product may bring some stability, both to the price and to the product's quality.

The European market with cheese producing countries such as France, the Netherlands and Denmark, is much larger than the USA. Pfizer has East and West European applications pending. (*Chem & Ind.* 4/16/90, p. 241).

## HDL CHOLESTEROL LINKED TO WAIST TO HIP RATIO IN OLDER PEOPLE

What shape is your tummy? And your hips? Taken together, these may be an independent indicator of HDL (high-density lipoprotein) cholesterol level in older people.

Researchers working under R.E. Ostlund studied 77 men and 67 women aged between 60 and 70, and found that the waist to hip ratio was a significant predictor of HDL cholesterol level. The use of this ratio reflects the amount of intra abdominal fat. (*New Eng J of Med* 322, 229-33).

## A NEW NON-CALORIC SWEETENER FROM SUCROSE ON THE HORIZON

Sucralose, a new non-caloric sweetener developed from sucrose by researchers at Tate & Lyle and Queen Elizabeth College, London is on the threshold of approval by FDA in USA.

The FDA in USA has indicated that it is satisfied with the safety of sucralose.

Sucalose is the first artificial sweetener made from sucrose and it is reported to taste very similar. Three of the sucrose hydroxyl groups are substituted with chlorine and the resulting molecule cannot be hydrolysed by the body. It is, therefore, calorie-free and about 600-times sweeter than sugar.

Tate & Lyle reports sucralose is stable under a wide range of food processing conditions and should allow manufacturers to expand their product ranges, particularly in areas such as baked foods, canned foods and soft drinks. Petitions for approval of sucralose have been made in 1987 to health authorities in USA, E.C., Canada and the UK. (*Chem & Ind.* 6/18/90, p. 170).

## CAROTENOIDS IN FRUITS

Researchers have identified the predominant carotenoids and Carotenol fatty esters in apricots, peaches, cantaloupe and ruby seedless pink grapefruit. Using reversed phased HPLC the researchers have shown the presence of Zeaxanthin and B-cryptoxanthin as well as lycopene, phytofluene and phytocine. Carotenoids are among the most abundant micronutrients in cancer preventive foods.

There is an increasing body of evidence to suggest that B-carotene has a protective effect against certain types of cancer. A Shibata et al have reported on the intake of green/yellow vegetables and the effect on serum levels of B-carotene in 671 men and 948 women. After allowing for the incidence of smoking, age and body mass index, the intake frequency of yellow/green vegetable is an important indication of serum B-carotene levels. (*Agric & Food Chem* 37, 1465-73, (1989)) *Internal J. Cancer* (1989), 44, 48-52).

## GREEN TEA CLEANS TEETH & PREVENTS TOOTH DECAY

'Green tea cleans the mouth'. This Japanese adage was confirmed last April by researchers at Osaka University and Taiyo Kagaku's Central Science Laboratories. A cup of green tea each day they say, will combat tooth decay.

The research team led by Dr. Onisi began screening primary school pupils. Onisi reports that children who drink a cup of green tea after lunch rarely had tooth decay.

The cariostatic properties of green tea, which a large proportion of Japanese drink in great quantities are due to various polyphenols in particular gallocatchine.

These combinations destroy streptococcus mutans, the principal bacteria causing tooth decay. Onisi claims that the cariostatic effect of these polyphenols is more potent than that of fluoride combinations.

A cup of tea taken with each meal has an undisputable prophylactic effect against tooth decay. (*Chem & Ind* 5/21/90, p. 309).

## CARBON DIOXIDE EXTRACTED NATURAL FLAVOURS & COLOURS GAINING GROUND IN USA AND ADVANCED COUNTRIES

The carbon dioxide extracted flavours and natural colours are gaining popularity in response to higher demand in advanced countries. Two major manufacturers in USA report a steady increase in demand and predict sales will continue to rise.

Universal Flavours Corp of USA reports a 100% increase in sales of CO<sub>2</sub> extracted natural flavors in 1989. The Company's CO<sub>2</sub> extracted flavors called 'Templar' essential oils are now cost effective and are finding their place in new products.

It reports production costs are comparable to costs of conventional method after the equipment for supercritical CO<sub>2</sub> extraction is paid off. The process of critical CO<sub>2</sub> fluid extraction has become standardised.

Another American company CAL-Pfizer has erected already a high technology commercial for CO<sub>2</sub> fluid extraction to produce the widest range of 'natural flavours and colors. The conventional heat distillation extraction process is said to leave some solvent in

the flavouring.

The CO<sub>2</sub> extracted flavors, on other hand, are devoid of residual solvents. Therefore, CO<sub>2</sub> extracts improve the overall flavor quality because extracts leave a natural fresh effect. CAL-Pfizer is currently conducting research on using supercritical CO<sub>2</sub> extraction techniques to produce colorings for beverages and Mexican food. The studies are targeting paprika and turmeric as possible sources for red, orange and yellow colours.

The company reports that extruded fish meat processed to resemble shell meat, called surimi, may be a major end use for CO<sub>2</sub> extracted colors in the near future. The Surimi market now centred in Japan is expected to spread to USA and Western Europe, causing an increase in demand for natural red coloring.

CAL-Pfizer is also researching fruit and vanilla CO<sub>2</sub> extracted flavors for use in low-caloric desserts. An explosive growth in European market for CO<sub>2</sub> extracted food colors and flavors is expected, because the European Community has stringent regulations covering the definition of 'natural food ingredients'. Legislation in Europe is definitely favouring natural food coloring and flavours. (*CMR* 7/16/90, p. 2).

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## Science Briefs

### FUNGUS TO WORK FOR TANNERS

The Central Leather Research Institute, (CLRI) Madras, has worked out a non-polluting, cost-effective method of removing hairs from hides and skins.

De-hairing of hides and skins is one of the first steps in leather-making. The most widely used method of de-hairing is the lime sulphide method. The hair gets pulped due to the high alkalinity and contributes in a large measure to the pollutants in the tannery effluent. This constitutes a health hazard to the lime-yard workers.

De-hairing with enzymes has certain advantages, especially from the pollution angle. (Enzymes are proteins secreted by living cells, which promote chemical reactions without themselves being affected.) Scientists in Poland have used pancreatic enzymes for the purpose. Most of the enzymes are manufactured by submerged fermentation, involving extensive downstream processing. This adds to the cost of production, and has, till now, stalled the adoption of enzyme-based methods of de-hairing.

Solid substrate fermentation, which has been used in the East for preparing traditional foods, has certain advantages over submerged fermentation. For one thing, it needs only a simple growth media. Owing to the lower moisture level and higher substrate concentration, the productivity is better. And because of the lower water content, there is less bacterial contamination.

For the past two years, the CLRI has been working on a cost-effective method of de-hairing involving a proteolytic (or protein-digesting) enzyme of microbial origin. After extensive screening, a new strain of *Aspergillus* (identified as a new *A. flavus* strain by the International Mycological Institute,

UK), was isolated. The strain grows abundantly on a solid substrate and produced large amounts of the enzyme protease. The fungus produced the maximum amount of enzyme after 48 hours of growth at 28°C and a substrate moisture content of 55 to 65 per cent.

The fungal enzyme was tried out as a de-hairing agent for hides and skins at the experimental tannery of the CLRI for a year. It was mixed with an inert carrier and applied in the form of a paste on the flesh side. The subsequent phases of processing were modified to obtain good quality leather from goat and sheep skins.

Among the advantages of enzyme de-hairing are the removal of the epidermal layer of the skin; in the lime-sulphide process, the hair roots get stuck in the grain layer. The pelt is cleaner and free from stains. Unlike in the lime-sulphide process, the hair remains intact, since the enzyme does not digest it. Enzyme de-hairing also turned out to be faster (five days, as compared to eight days for the lime-sulphide process).

The paper reporting the work, published in *Indian Leather* and authored by Ratna Chakraborty and others, does not give the comparative economics of the process, but since it is claimed to be less time-consuming than the lime-sulphide method and does away with the need for an effluent treatment plant, it should work out much cheaper.

### FOOD VERSUS MEDICARE IN BODY GROWTH

The conventional wisdom that diet and disease are equally important in their effects on health has been confuted by a study done by the well-known statistician Prof. P.V. Sukhatme with Prof. W.E. Edmundson.

In a paper in *Current Science*, the authors of the study observe: "Generally, disease is a more important com-

ponent of health than diet." The data for the study comes from a pioneering experiment initiated in 1976 in Kirkatwadi by the Marathi Vigyan Parishad, Pune. School-going children were taught the importance of preventing garbage accumulation in the vicinity of the school. A latrine was constructed, the drinking water well was capped and its water chlorinated. Biogas plants were built for the villagers. This was followed by a marked fall in diarrhoea cases.

In 1984, the Maharashtra Association for the Cultivation of Science (MACS), Pune with funding from the Department of Science and Technology, extended the Kirkatwadi experiment to eight more villages. By the end of the third year, diarrhoea cases fell by more than one-third. Rates of body growth were higher in villages with latrines and drinking water supply, compared to villages without these facilities.

Most illnesses are accompanied by a loss of appetite. This worsens malnutrition by necessitating a higher food intake to meet the elevated basal metabolic rate which accompanies fever by requiring higher protein intake. This is particularly true of protein-calorie malnutrition in infants and children, where the fully developed clinical symptoms are brought on by diarrhoea.

The MACS study apparently contradicts the Narangwal experiment conducted by Indian Council of Medical Research in 1978. Since all the villages involved had protected water supply and latrines, the ICMR study group decided that strengthening the medical services and food programmes would be more effective than educational programmes on the importance of latrines and potable water. However, the food programmes failed to achieve body growth rates comparable to those in the US. Clearly, body growth stops when the ethnic potential is reached. The authors opine that feeding programmes aimed to bring our children in line with those

of developed countries are less effective than appropriate social action towards changing the lifestyle in order to improve cleanliness and hygiene.

## PLANTS PROBE FOR ANTI-CANCER DRUGS

London-based Glaxo Pharmaceutical group has joined forces with US researchers in a major five-year project to screen over 2,500 plants for anti-cancer activity.

Plants from the gardens of suburban semis to the dark recesses of the Amazonian rain forests are being collected and sent via the University of Illinois in Chicago and the Research Triangle Institute (RTI) of North Carolina to the Glaxo Group Research Company's laboratories at Greenford in London.

The project, with £2.2 million financial backing from the US National Cancer Institute (NCI), reflects the importance that is now being placed on natural products as a source of effective new drugs. The search is also a new area of involvement for a major pharmaceutical company.

A spokesman for the project commented in London: "Two of the top 10 compounds already in use for cancer chemotherapy are derived from the Madagascar Periwinkle. The leading anti-cancer agent currently in phase two clinical trials, also comes from a plant".

The NCI research funds will be divided between Illinois University and the RTI, with Glaxo having first refused on any promising leads that emerge from the search and the option of developing them.

The spokesman continued: "People have been interested for sometime in the idea of getting new medicines from natural products. But it is only quite recently that we have started to have the technology to handle them. The real change has been the development of

good new bioassays such as high volume receptor-based screens which can handle 5,000-6,000 samples a week via receptor-binding assays and radio-immunnassays. Before, we had the intellectual interest, but not the practical or economic ability to back it up."

Under the joint agreement, Illinois University will arrange for the collection of samples worldwide, identify them and use its huge database to check what is already known about the potential therapeutic activity of particular specimens.

When the samples have been processed at Illinois and RTI, all three partners will put specimens through a total of 25 different biological assays to screen them for anti-cancer activity.

Dr. Melanie O'Neil, research leader in Glaxo's natural products discovery department, said: "Some of the assays take just a few minutes, others hours or days, but the longest will only take about a week." Promising results from any of the teams will result in further tests and if these confirm the finding, the go-ahead will be given for large scale extraction and identification of the active compounds by Glaxo.

The Glaxo team, led by Dr. Murray Tate, will concentrate on hormone sensitive tumour assays, looking for compounds that could be effective against cancers such as breast and prostate tumours.

Dr. O'Neill commented: "We have had collaborations on plants before, but this is by far the largest link-up. It will mean access to a far greater number of plant species as well as the database at Illinois".

The doctor says the scientists have no clues as to which plants might unlock the door to new drugs able to fight cancer. She admitted: "We know so little about the medicinal potential of

get something useful from garden as from somewhere like tropical rain-forest".

## POTATOES THAT COMBAT PESTS

Potatoes have been genetically engineered to combat pests. A crop of such potatoes has been harvested in Britain. The trial desired variety of potatoes, grown in a carefully guarded potato patch in Norfolk, eastern England, had been genetically modified to incorporate a gene taken from the pea which produces a lectin and appeared to protect the potatoes from pests like tuber moth and the Colorado beetle.

According to Dr. Jan Cubitt, head of the technology transfer unit of a national seed firm which carried out the field trial, the lectin gene was expected to give considerable cost-saving benefits to farmers in many countries where pests attacked the leaves, roots and tubers of plants. It would also help the environment by reducing the need for insecticides.

The lectin gene was identified for its pest-control qualities by researchers at Durham University in northern England. After being identified and isolated, the gene was incorporated into a transforming organism or agro-bacterium which has the ability to penetrate the potato.

The agrobacterium was altered so that it could no longer create tumours but retained the ability to enter and take a fragment of pea gene into the genetic material of the potato.

The result is a vegetable that has the appearances of a normal potato but produces lectin in its leaves and roots.

It does not kill pests but appears to slow down their development so that they do not develop their full potential.

## NEW ANTISEPTIC

Soviet scientists have created a new antiseptic, Katapol, which is much more effective than its widely-used analogues. Years of clinical tests prove this. Katapol cuts two times the gravity and frequency of post-operational complications and five to seven days the time of healing.

Most importantly, as an anaesthetic with prolonged action it eases suffering of the patient. Katapol facilitates dilution and removal of puss and separation of necrotic tissues. It also prevents bacterial propagation and simultaneously intensifies the action of antibiotics, which finally do away with the bacteria.

On the basis of Katapol, applied in aqueous-solution form Soviet scientists have developed the Asiplen ointment for use in hospitals, at home, while travelling etc.

## MOUSE TO HELP DRUG RESEARCH

Scientists have a mouse with human (chronic myelogenous) leukaemia. The new animal model will permit testing of new drugs before they are given to human patients.

George Daley and colleagues of the Whitehead Institute for Biomedical Research in Cambridge, MA, have found that the cancer is, as suspected, triggered by a hybrid gene, combining a breakaway ABL gene from chromosome 9 and another BCR from chromosome 22. The hybrid gene's protein product P 210 transforms cells.

The scientists inserted the BCR/ABL gene, using a virus as vector, into mouse bone marrow. Then these cells unleashed the cancer in other mice. Now researchers aim to develop a drug to

## MAKING PETROL FROM PLASTIC

At a time when ever-increasing amounts of plastic trash are defying the ability of cities to find effective and safe disposal methods, Japanese researchers have proposed an unusual solution—turn it back into fuel. The Government Industrial Development Laboratory, Hokkaido (GIDLH) and a private company, Fuji Recycle Industries K.K., have recently found a method to transform certain types of plastics into gasoline and kerosene.

The method uses a catalyst to reverse the process that turns oil into plastic. The catalyst is produced by Mobil Catalysts, a joint venture between Mobil Chemical Industries of the US and Tosoh Corp. of Japan. According to Kazuo Izumi of GILDH's, Research Planning Section, "the process first takes place in a melting vessel at 300°C, then in a cracking reactor at 400-420°C and finally in a catalytic reactor at 200-350°C.

Only plastic material is added to the melting vessel, though paraffin is sometimes used during the initial stage of lower viscosity. After melting, the gas produced is transferred to the two reactors where the catalysts are located. Under normal conditions 1 kilogram of plastic can produce half a litre of petrol and the same amount of kerosene and diesel oil. A future goal is to produce higher aromatic compounds using the same procedure.

The types of plastics that are convertible into oils include polyethylene, polypropylene, and polystyrene; these account for about 50% of all plastics currently in use. Toshio Hirota, president of Fuji Recycle, claims that the octane rating of the fuel produced is very high between 90 and 100. It can be put directly into an automobile engine.

major cost of process is separating the many different types of discarded plastic.

Even though hurdles remain before the discovery can be put to commercial use, news of the discovery sent Tosoh's stock price shooting upwards. Japan's Ministry of International Trade and Industry, which played the largest part in the development, owns 50% of the patent rights. Fuji Recycle and Mobil Oil (U.S.) share the other half. Hirota says that there are plans to set up three or four plants within the first half of 1991, mainly for local government-related organisations in Taiwan and Korea.

--Asia Technology, August 1990.

## CAN EARTH SURVIVE ENVIRONMENTAL INSULTS?

Global warming — plenty of clues are pouring in to prove that carbon dioxide level is going up with industries spewing out tonnes of noxious gases into the atmosphere. Ozone depletion — industry's lies have been nailed and chlorofluorocarbons (CFCs) have been identified as the culprit, which punches holes nonchalantly in the ozone belt. Trees are vanishing at lightening speed and toxic chemicals and waste mounds are piling up to defile and deface the earth. Will the earth survive all these environmental abuse and industry's insults?

Yes, assert the protagonists of the Gaia hypothesis. The Gaia hypothesis (Gaia stands for mother earth in Greek), propounded by the British scientist and inventor James E. Lovelock, and the US microbiologist, Lynn Margulis, says that a biotic control mechanism maintains climate and well-being at a suitable temperature for life on earth.

Life wields control over physical and chemical environment and biota can effectively and directly manipulate the environment for its own purpose. Earth has

It acts like our physical body, maintaining temperature wherever it is—whether in an ice-cold country or hot region. It functions like a thermostat, turning on furnace or an air-conditioning unit, feeling the pulse of change.

To bolster their arguments, they say, if based on the modern theories that the sun was 25 per cent less luminous four billion years ago, it should have been a frozen ball. But proofs are there for rocks which formed 3.8 billion years ago and fossil evidence of bacteria, the primitive form of life. So, they dish out a new explanation, the methane and ammonia were present in plenty and these trapped infrared radiation and produced a sort of super green-house effect in certain pockets on earth for living organisms to thrive.

The gaia hypothesis has been ignored by most of the scientific community and the detractors say that pollution is such an enormous problem now that playing with this kind of environmental brinkmanship and belief in such mystical protection of the earth may prove to be too costly.

Blind people can now 'see' with sound, like bats that avoid obstacles reacting to the echoes of their own sounds, says an electronics engineer of Florida. He has developed an echolocation system which functions like a natural radar. It is a battery-powered gadget and measures 18-inches long. The device produces stream of ultrasonic signals, which bounce back to the system. Since the signals are too fast for human ears to decipher, an electronic delay inducer makes them 'understandable' for the human ears.

With this the blind man can now hear the distance and these are claimed to be as skillful as the braille for reading. It is a kind of advanced hearing aid and gives 'sound images' of the surroundings, the engineer claims. Two young engineers in the US are looking ahead on the future road of fuel for cars.

skyrocketing gasoline prices have propelled them to build a car that runs on liquid air chilled to -321 degree Fahrenheit.

When this chilled liquid air is added to a little natural gas, the heated compressed mixture will ignite and the expanding gas will fire the power for the car. The acceleration is comparable to that of gasoline-powered vehicles. This fuel combination also does not produce any smog, say these engineers.

The price also will work out to the same as that of gasoline, the future visionists say. But the auto industry is rather cool to their new concept since it says it will mean retooling the entire industry. This, however, has not dampened the moods of the inventors and they are still knocking the doors with the fond hope that the auto industry will shift the gear to change in tune with the new fuel mixture of the future.

New hopes are dawning for NASA, which has been receiving some jolts recently in its programmes. The \$1.6 billion Hubble space telescope, with its devastating optical flaw, blemished the image of NASA. But now the astronomers and scientists are a bit relaxed since they have found out that the flaw is in the primary mirror, which is a 2.4 metre disk glass. They say if the flaw had been in the second mirror, it would have meant more trouble to the hubble.

The 0.3-metre secondary mirror takes the collected starlight from the primary mirror and bounces them back into the scientific instruments. Astronomers will be revisiting the telescope in 1993, when it will be possible to replace the flawed mirror, they feel confidently. On the space shuttle front too, they have received some good news. The mysterious fuel leaks bogged down the shuttle trips this June. Now the leaks have been found to have no connection with the shuttle design. So the shuttles will be back in action. The Ulysses solar

schedule on October 5. Besides, a package of telescopes known as Astra-I is ready for launch in September.

The US biotech industry has breathed a sigh of relief, when recently a 15-year old lawsuit ended in its favour. The California Supreme Court has passed a ruling that a patient does not own tissues removed from his body or have rights to profits from researches derived from these tissues.

The NES judgement has struck down a ruling in 1988, which said a patient had the right to share profits derived from surgically removed tissues. But the new ruling, however, says that a patient may sue if the physicians who removed the tissues failed to obtain informed consent to do research on them.

## RESEARCH PROJECT TO IMPROVE 4 MAJOR CROPS

The Tamil Nadu Agricultural University (TNAU) Vice-Chancellor, Dr. S. Jayaraj, said, the intensive research on agricultural biotechnology launched in the country would focus on improvement of four major crops.

Presiding over a three-day national seminar on biotechnological approaches for upgradation of agricultural and horticultural crops, he said the crops identified for the research were rice, wheat, mustard and chicken-feed. The five major centres of plant molecular biology established in the country would later expand the scope to other field crops like groundnut, green legumes and vegetables and forage crops. Dr. Jayaraj said while three plant molecular centres, including the one in TNAU, had started functioning, the other two would take up research work soon. The centres would evolve genotypes of these crops for varietal improvement with a view to achieving, among other things, higher per-unit productivity with lesser farm inputs and improved nutrient value.

## New Products

### XRF ANALYZER

The Model 8620 XRF analyzer from Asoma instruments uses the principle of X-ray fluorescence for quantitative, non-destructive analysis of liquids, solids, pastes, slurries, films, filter deposits, etc. Its bench top size, rugged design, and easy operation enable it to be used at the critical measuring point by non-technical personnel. Plant and production line operations benefit tremendously from this real-time analytical information. Processes can be controlled much more closely and quickly, resulting in great savings in materials, energy and time and significant reduction of waste. Research laboratories use the 8620 as a screening tool or for rapid analysis of materials during process development studies. For details contact: Motwane Pvt. Ltd., 11, Nanik Motwane Marg, Fort, Bombay-400 023.

### ACID FUME SCRUBBER

A simpler and effluent conservative device called "plate scrubber" has been introduced in the market for applications of acid fume scrubbing in fume extraction systems for steel pickling lines and other processes. The plate scrubber is provided in all PVC/FRP material of construction and therefore, is completely corrosion resistant. The scrubber, air pollution control device, generates relatively much smaller water effluent and, therefore, saves on recurring effluent treatment & generation costs. The plate scrubber has been designed specifically for higher contaminant scrubbing efficiency. It is being manufactured in the country in technical collaboration with Ledge Engineering Inc. Canada. For details contact: SK Systems Private Ltd., 510, Hemkunt House, 6, Rajendra Place, New Delhi-110 008.

### LUBRICATED PLUG VALVES

Crescent Valves, in collaboration

with Thevignot (France), manufactures lubricated plug valves for use in hazardous, high pressure and high temperature applications, in the petroleum and gas industries. They include a lubricating system which under pressure provides a constant film of sealant between the tapered surfaces of the plug and the valve body. This Delta Desco Scalant will be chosen according to the conveyed fluid. The conical surfaces of the plug and of the valve body remain in a close and permanent contact which impedes any foreign matter to come in and damage them. Options offered include: reduced bore/full bore, two/three/four way with 'T' and 'L' ports etc. The valves are manufactured conforming to API, ANSI, ASTM, BS and DIN standards. For details contact: Crescent Valves Mfg. Co. Pvt. Ltd., 119, Bajaj Bhavan, Nariman Point, Bombay-400 021.

### DIAGNOSTIC TEST SYSTEMS

Waldheim Pharmazcutika is an Austrian pharmaceutical company producing drugs for use in humans as well as in vitro diagnostic test kits for the detection of antibodies of various life-threatening infectious agents. This line of diagnostic products has already received much attention around the globe and is constantly expanding to include all detection methods currently in use so that market demand can be served in the best possible way. The great emphasis of Waldheim diagnostic test systems is on detecting infection by human retroviruses such as HIV-1 by HIV-2 and HTLV-1 by means of indirect immunofluorescence and recombinant antigen technology. Both screening and confirmatory testing for Human Immunodeficiency Virus can be accomplished by choosing an appropriate combination of Waldheim diagnostics—for instance, RECODOT Dot-EIA plus FLUOROGNOST-HIV IFA. Another kit, ENTAGNOST, allows detection of antibodies to *Entamoeba histolytica*, the causative agent of the most dangerous

form of amoebiasis. Waldheim Pharmazcutika seeks marketing cooperation for its complete diagnostic product line and welcomes enquiries. Waldheim Pharmazcutika GmbH, Boltzmanngasse 11, A-1091 Wien/Austria, Tel: 116487/Fax:0222/34662844.

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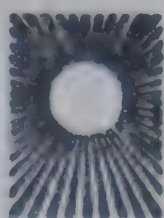
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# Chemical Plant Developments

JAMES LOCK

Consultant Editor, "Processing" London

## ICI OPENS NEW ELECTRODE COATING FACILITY

ICI has successfully started up its new Metcote electrode coating plant at Warrington, in Cheshire, northwest England. This £4.5 million plant, which has an annual production capacity of 200,000 m<sup>2</sup> of coating, will address the increasing demand for ICI's electrode coating technology.

Orders for ICI's FM21 membrane electrolyser technology have taken off rapidly in the past four years. Not only is the FM21 an environmentally friendly process, it allows conversions from the environmentally unfriendly mercury or diaphragm cell to be achieved without fuss.

The rapid development of new applications for electrode coating has also been a major driving force for investment. In addition to the worldwide chloralkali industry, other growth areas for ICI coating technology include electrogalvanising, metal finishing, electrochlorination, chlorate production and

precious metal recovery. This growth potential will fuel the demand for both anode and cathode coatings.

The production of ICI electrodes involves carefully controlled application of Metcote coatings based on precious metal or precious metal compounds to substrates fabricated from metals such as titanium, niobium, tantalum and nickel. These coatings act as electrocatalysts. At the cathode the overpotential and, therefore, the amount of electricity required, is reduced, as is the risk of corrosion.

### Reconditioning Service

The number of chloralkali manufacturing plants around the world based on FM21 electrolyzers has increased by 50% in the past five years. ICI has forecast that FM21-based chloralkali capacity will grow annually by 200,000 tonnes until the year 2000.

ICI's coating technology is used in the chloralkali industry to create cost-effective, efficient electrolyzers. The combination of ICI coatings and titan-

ium electrodes, of both ICI and other design, provides efficient operation and long-term reliable performance. Worldwide, more than 3 million tonnes of chlorine are produced annually using ICI coating technology.

The new plant provides a comprehensive reconditioning service for anode types like mercury rod, expandable diaphragm cell, or mesh membrane, from plants using any electrolytic technology. It is expected that the ending of certain patents and long-established supplier agreements within the chloralkali industry will give ICI an opportunity greatly to increase its market presence, providing a high-quality solution to customers wanting alternatives to the old monopoly suppliers.

### Computerised Systems

In addition to the large number of anode shapes and sizes that can be coated, the ICI plant is also capable of handling a wide selection of coating types. The plant, operating 24 hours a day, in five shifts each comprising five operatives, is designed with the empha-



A range of electrodes which can be coated at the new plant

sis on providing integrated systematic workflows to allow orders to be turned round quickly and individual orders quickly identified.

Computerised production planning and tracking systems have also been installed, further to improve production and delivery times. Electrodes pass through successive operations of stripping, gritblasting and etching, followed by coating and spraying.

State of the art clean room technology is employed. A modern, powerful ventilation system protects employees from potentially hazardous precious metal salts, and the whole building, which incorporates changing, showering and rest rooms for personnel, is under close environmental control. Offices, laboratory and production facilities are all under one roof to make highly skilled technical support readily available to the production management.

For further information contact Electrochemical Technology, ICI Chlor-Chemicals, PO Box 14, The Heath, Runcorn, Cheshire, United Kingdom, WA7 4QF.

## NON-INTRUSIVE MIXING ADVANCES VISCOSITY CONTROL

Non-intrusive mixing offers the process and production engineer a wealth of options and opportunities. BHR Group (formerly the British Hydromechanics Association) has already successfully introduced its Nimix mixing vessel into a variety of industries such as paint, food, fine chemicals and, more recently, lost-wax casting or investment casting, and development work is exploring its potential for mixing drilling fluids and use in polymerisation reactors.

The main benefits of using Nimix include:

- \* Rapid and thorough blending of

shear-thinning materials.

- \* Reduced air entrainment while dispersing powders into liquids.
- \* Precise control over agitation levels.

Homogeneity in packaging or coating lines can be maintained because Nimix produces upwards flow from the base of the vessel, even for very low liquid levels. In dipping vessels, Nimix provides complete access and reduces damage risk to dipped items as no moving parts enter the vessel.

Safety is also improved. Solvent loss in closed vessels is reduced and intrinsically safe air drives with no rotating parts are available.

### Mixer Strengths

Nimix blenders operate on a simple principle. The vessel consists of a vibrating diaphragm which forces liquid back and forth through a diode plate. The plate has a central hole shaped so as to promote upwards rather than downwards flow, and a ring of outer holes shaped to promote flow in the opposite direction. With the diaphragm oscillating many times a second, strong flow is produced throughout the vessel.

The Nimix's strengths as a mixer arises from the fact that the diaphragm and plate are situated at the base of the vessel, producing vertical flow from the bottom. Hence, a suspension can be maintained or settled solids re-suspended.

Because this flow pattern avoids the formation of a vortex at the surface, air entrainment -- a common problem with rotary mixers, especially during powder-liquid dispersion -- can be greatly reduced.

Mounting a Nimix on the base of the vessel means that mixing can continue down to very low levels. The same principle can be applied to disposable packaging such as 200-litre drums or 20-litre pails, using the existing base as a dia-

phragm so that the package doubled as a mixer.

### Enormous Potential

Moreover, with the diaphragm on vessel base, the Nimix drive can be instrumented for process measurement. When stationary, the Nimix diaphragm bears the weight of the fluid above, allowing a measurement of force to infer density. Unlike load cells mounted under the vessel, there is no vessel deadweight to tare off.

When the diaphragm is in motion, loads depend on both density and viscosity, with viscous forces arising through the flow of material through the plate, and shear in the main body of the fluid. Measurements of drive dynamics open up the possibility of direct monitoring and viscosity control. The technique would yield a continuous measurement, allowing automation of the mixing process and data logging as part of a quality control system.

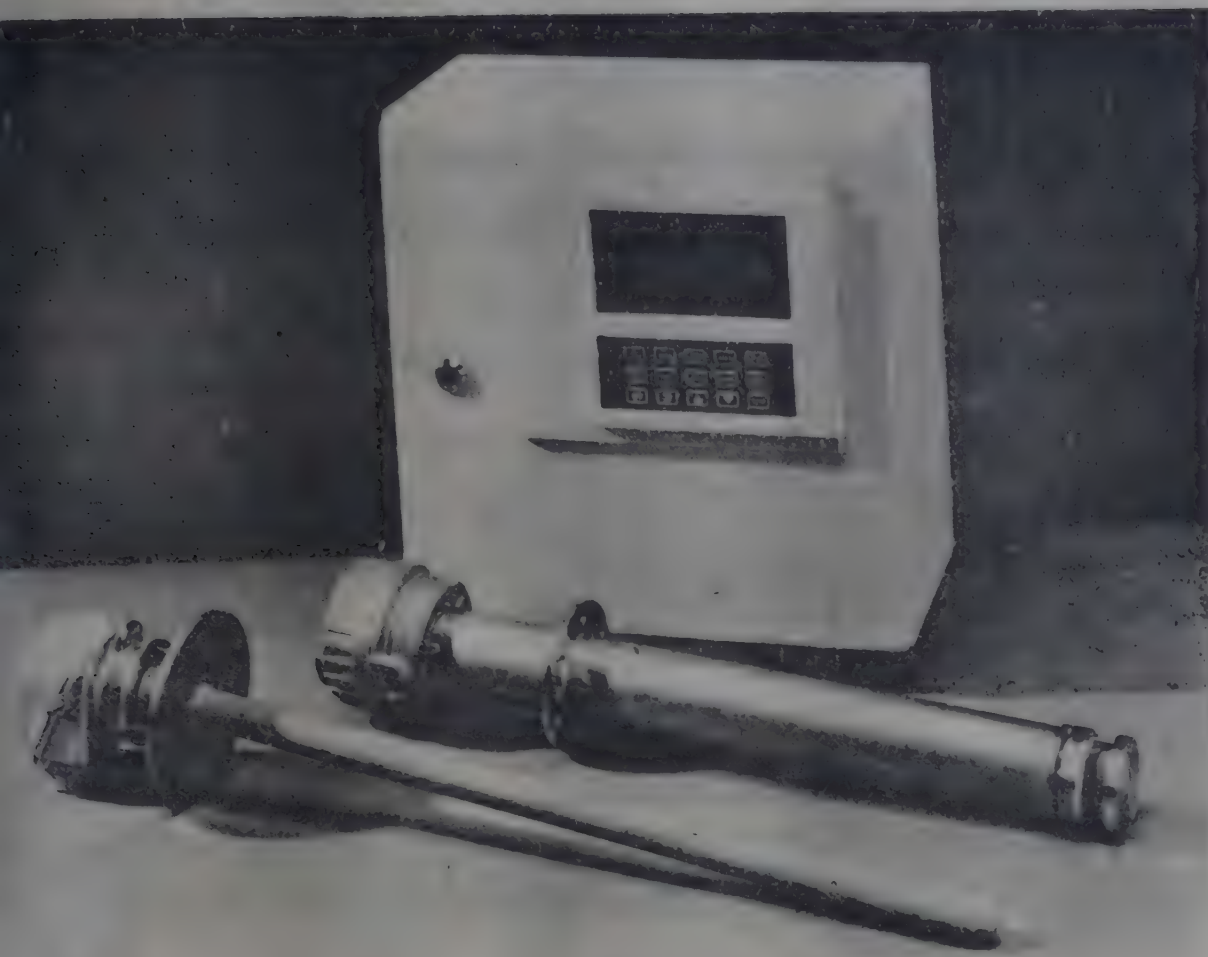
The inherent suitability of Nimix for settling products will enhance accuracy and as the method is in situ, the need for sealing, cleaning or sampling is avoided. Work is proceeding to make the technique an integral part of a Nimix mixer. It could also take the form of a relatively small unit attached to a much larger vessel mixed by a conventional rotary impeller.

For further information contact: BHR Group Ltd., Cranfield, Bedford, United Kingdom, MK43 0AJ.

## ADVANCED ZIRCONIA OXYGEN ANALYSER

Kent Industrial Measurements has introduced an advanced microprocessor-based flue gas oxygen analyser transmitter for energy management in large and medium-sized boilers.

The ZMT analyser/transmitter ha



The ZMT zirconia oxygen analyser/transmitter

been designed to provide accurate measurements of excess oxygen in flue gases in conjunction with Kent's existing low- and high-temperature zirconia oxygen probes.

An accurate measurement of oxygen in the boiler smoke box or flue duct enables the boiler to be trimmed for optimum combustion efficiency. If there is too little air, complete combustion is not achieved, leading to inefficiency and pollution; too much air and heat escapes up the chimney, again leading to inefficiency.

The ZMT displays the calculations made by its microprocessor of the cell temperature and the percentages of oxygen ( $O_2$ ), carbon monoxide (CO) and inferred carbon dioxide ( $CO_2$ ), with options of combustion efficiency, and flue and air inlet temperature measurement, to provide the maximum information for energy management requirements.

One of 17 different fuel options can be programmed in to ensure that the microprocessor takes account of the different fuel constants in order to make

accurate combustion efficiency calculations. Both single fuel and dual fuel boilers can be monitored with either automatic or manual changeover between selected fuels.

#### Temperature Probes

When used with the low-temperature ZFG probe, the analyser/transmitter controls the temperature of the probe heater at  $600^\circ C$ , the minimum practical temperature at which zirconia measures oxygen accurately.

With the high-temperature ZGP2 probe, the analyser/transmitter compensates for probe temperature variations, measured by a thermocouple mounted within the probe. Both types of probe require a reference air supply, which is now provided either by an air pump or via a pressure regulator within the analyser/transmitter, avoiding the need for additional equipment.

Programming the ZMT is done by means of a series of frontmounted tactile membrane switches with two levels of security to avoid accidental changes. Measurement readings and program-

ming information with prompts are shown on a five-digit vacuum fluorescent display and a 20-character dot matrix display respectively.

Other features of the ZMT include a diagnostic scroll, up to three analogue outputs, up to four relay outputs, retransmission and serial data communication.

These systems have Central Electricity Generating Board approval; they are quality assured to BS5750 Part 1; and radio frequency interference (RFI) testing has been carried out by an independent authority.

Further information can be had from Kent Industrial Measurements Ltd., Howard Road, Eaton Socon, St. Neots, Huntingdon, Cambridgeshire, United Kingdom, PE19 3EU.

#### SHOWA DENKO TO BUILD PLANT

Showa Denko of Japan is to build a 60,000 m.t./year grassroots polyethylene plant using the *Unipol* process of Union Carbide Chemicals & Plastics Co. (UCC & P). The plant, to be constructed at Oita, Kyushu, Japan, will produce both linear low and high density polyethylene and is slated for completion during the third quarter of 1991.

In obtaining the licence, Showa Denko also agreed to disclose to UCC&P its existing high density polyethylene product know-how for use in the *Unipol* process. UCC&P, meanwhile has acquired an option to obtain a licence and rights to use Showa Denko's polyethylene catalyst for the *Unipol* process.

The plant will mark Showa Denko's initial full scale manufacture of lldPE. The Japanese producer plans to combine the capabilities of the *Unipol* process with its own considerable polyethylene technology to develop products tailored to the Japanese market.

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# Diversification of Feedstocks in Fertiliser Production\*

B.K. Jain

Director (Technical), The Fertiliser Association of India, New Delhi

## Abstract

The spectacular growth of Indian fertiliser industry is a saga of development. The goal towards increasing self-reliance in the availability of fertilisers had been vigorously pursued keeping in view the country's resource endowments. The feedstocks use pattern has changed over the years in tune with the evolving resources on the one hand and responding to the emerging technological possibilities on the other. Appropriate strategies had been adopted with regard to choice of feedstock, technology and other relevant policy parameters. The paper briefly describes the diversified usage of feedstocks in nitrogenous fertiliser production.

Over the last 40 years, India has made impressive progress in the development of all aspects of the fertiliser industry. India's chemical fertiliser industry has become so dominant that India's basic chemical industry has become synonymous with that of development of the chemical fertiliser industry. India now ranks as the fourth largest fertiliser producer in the world. The remarkable growth of Indian fertiliser industry has made a considerable impact on the national and the international scene. Apart from fertiliser, the industry is also providing useful raw materials like methanol, nitric acid, ammonium nitrate, formic acid, industrial gases etc., for rapid expansion of other critical sectors of the chemical industry. The capacity build up and number of 'N' plants is shown in Table 1.

Table 1

## TOTAL CAPACITY AND NUMBER OF OPERATING NITROGENOUS FERTILIZER PLANTS

Year	Cum. capacity (000'te N)	Number of plants 'N'
1951-52	89	4
1961-62	246	8
1971-72	1,487	20
1981-82	4,732	37
1985-86	6,695	47
1987-88	7,083	49
1988-89	8,148	52

## The Initial Phase

The first synthetic ammonia plant in India of a capacity of only 5 tonnes per day was built in the then State of Mysore in 1941. The plant was based on electrolysis of water for production of hydrogen. The next plant, Fertilisers & Chemicals Travancore (FACT) was built in 1946 in the then State of Travancore & Cochin. The pioneering aspects of FACT was that wood was gasified to produce the gas for production of ammonia.

The great Bengal famine in 1943 and serious food imbalance in the wake of partition, drove home the need for growing more food on a planned and systematic basis, and consequently, recognition of the importance of fertilisers. The commissioning of the first large size ammonium sulphate plant at Sindri in 1951 almost coinciding with the commencement of the planning process in the country constituted the first major landmark. Ammonia production was based on coke gasification and ammonium sulphate from gypsum to avoid dependence on imported sulphur. Sindri was an outstanding success and it laid the foundation for the massive domestic fertiliser industry which followed. A coke oven plant was installed at Sindri in 1953-54 to replace the purchased coke. Further, expansion of ammonia capacity was based on utilising the coke oven gas. FACT's expansion from 10,000 to 20,000 tonnes of nitrogen was based on electrolytic hydrogen. Recognising the need to set up more fertiliser plants to keep pace with the expanding requirements of nitrogenous fertilisers, two Committees set up by the Government of India, recommended establishment of fresh nitrogen capacities at Nangal, Rourkela, Neyveli, Trombay and Gorakhpur based on different available feedstocks.

The plants at Nangal with a capacity of 80,000 tonnes nitrogen per year with electrolytic hydrogen and Rourkela with 1,20,000 tonnes nitrogen with low temperature separation of hydrogen from coke oven gas (available from Steel plant) were planned for production of calcium ammonium nitrate. The basic decision to build Nangal on electrolysis was linked with availability of abundant cheap hydro-electric power and extracting heavy hydrogen for the production of heavy water for the nuclear power programme. The plant at Neyveli was based on gasification of lignite as a part of an integrated lignite development complex for power generation.

\* Paper presented at International Seminar on Petrochemicals and Plastics held at Hyderabad, 19-22 April 1990.

## Naphtha as Feedstock

Towards the end of 1963, a spectacular technological breakthrough was achieved in the developed countries particularly in the USA, in case of naphtha for the production of ammonia. In India the advent of HYVs epitomising the onset of Green Revolution in mid-sixties gave added urgency to the need for rapid growth of fertiliser capacity within the country. Fortunately, the new technology came at a time when India's needs were the most critical. There was imbalance in the demand for petroleum products which resulted in a surplus of petroleum naphtha; at the same time, there was great need to develop fertiliser production within a short period of time. There was also shortages of power in many areas which limited the choice of plant locations. The newer technologies based on naphtha helped to solve the surplus naphtha problem of those days. The use of centrifugal compressors permitted a high degree of energy utilisation from waste heat generated in the chemical reactions to reduce the requirement of electrical power considerably. The industry gave a befitting response to the need of the hour, as a number of plants mainly in the private sector such as GSFC-Baroda and CFL-Vizag, both in 1967, IEL-Kanpur and SFC-Kota in 1969 were commissioned. The result was a phenomenal growth in installed capacity from 0.2 million tonnes of N in 1961-62 to 1.5 million tonnes in 1971-72.

The preference for light hydrocarbon feedstocks like naphtha or natural gas was to a great extent influenced by several sophistications which were introduced in the technology for production of ammonia, besides the added attraction of cheap feedstock, as crude prices were quite low. As a result, there was a quick succession of investment decisions taken on naphtha-based large scale units starting with Durgapur and Cochin followed by the plants at Kanpur, Madras, Barauni, Goa and Mangalore. Plans which were drawn up earlier to set-up coal based units at Korba, Singareni etc., based on the use of conventional processes were all set aside, as there was better economics in going in for the new generation naphtha based plants.

## Coal based ammonia

An overall review of the sanctioned capacity, however, showed by 1968 that a point was fast approaching when naphtha allocations for fertiliser production might soon exceed domestic availability and call for imports of naphtha to meet the demand. At the same time, there was an apprehension that, with increasing demands on crude, a crisis point in regard to supplies might soon be reached and petroleum and its products might ultimately be priced out of reach of countries like India, which in the late sixties, had problems of foreign exchange availability to contend with. It was in these circumstances that steps were taken to revive schemes for coal

the coal based plants was done in 1968-69 after careful evaluation by technical committees and plants were sanctioned at Ramagundam, Talcher and Korba in 1970 on this basis. While the first two projects were taken up for implementation, the third one at Korba was kept in abeyance due to constraints of resources and pending observation of the actual performance of the other two plants.

## Switch over to fuel oil

In view of the uncertainties of success of the coal based projects and at the same time, the need to push forward with plants for additional indigenous production of nitrogenous fertilisers, a decision had to be taken to continue with some additional petroleum based units to fill the demand/supply gap. The question arose as to which petroleum based feedstock would involve the least amount of foreign exchange outgo in case import of feedstock became inevitable. The Committee which went into these details in 1970-71, found that high sulphur heavy stock was the best choice, as its cost in the international market was about half that of naphtha and its general acceptability as a fuel was dwindling because of increasingly stringent environmental protection measures being enforced in the more industrialised countries. It was argued that this would keep its price in the international market always lower than that of other petroleum products. Established technology was available for its use as feedstock for ammonia production with full containment and recovery of the objectionable sulphur in the material. Five units based on such heavy stock were set up at Panipat, Bhatinda, Nangal, Sindri and Bharuch and the old unit at Neyveli based on light nite also switched over to fuel oil.

## Rapid expansion based on Gas

The later half of the seventies brought in the heartening prospect of an expanded indigenous source for light hydrocarbon feedstock with the discovery of crude and free gas fields off the West Coast and on-shore in the north-eastern part of the country. Feedstock policy was revised in the context of this discovery. Plans were drawn up to segregate the higher hydrocarbons from this gas for domestic fuel and petrochemical feedstock and earmark the predominantly methane fractions for ammonia production. Consequently natural/associated gas emerged as the predominant feedstock in the eighties following newly found reserves in Bombay High and the South-Basein Region. The thrust continues to be on gas in view of identification and exploitation of more and more reserves of gas in various other parts of the country, including Krishna-Godavari and Cauvery Basins. In fact, the share of natural gas in the installed capacity which was only 13% in 1980, has already gone upto 41% and is slated to further increase to about 52% in 1995. As a result, the share of naphtha already down from a level of 52% in 1980 to 31%.

## Natural Gas -- Preferred feedstock

The subject of optimum utilisation of natural gas has been engaging the attention of the planners in India since mid-seventies. The Working Group set up in 1976 to examine the optimum use of natural gas on the basis of economic cost-benefit analysis keeping in view the known availability of natural gas at that time, came to the conclusion, that the best option would be to utilise available gas for the manufacture of urea required to meet the domestic demand. The Government of India set up another Group in 1979 (Satish Chandran Committee) to specifically go into the question of optimum utilisation of off-shore gas. The Group re-emphasised the validity of the earlier policy of reserving the country's limited resources of hydrocarbons, both liquid and gaseous, for high value products and not utilise them purely as fuel. The Group clearly indicated that such gas need not be used for power generation so long as it can be used for production of fertilisers or other products, where the opportunity cost was higher. The consensus about gas use planning in 1980 in India was clearly loaded in favour of fertiliser production. About 45% of total gas use of about 1.6 billion cubic meters in the country was in the fertiliser sector in 1980. The Planning Commission set-up another Group in 1984 to go into the possibility of earmarking some gas for power generation in view of the additional projections of availability of natural gas and recommended setting up of three gas based power plants in the western and northern parts of the country, on the basis of supply of 6 million cubic meters a day of lean gas. The recommendations of the three Groups are summarised in Table 3. Until about mid-eighties, the main contender for gas use in the country was the fertiliser sector;

the next major user has been the power sector. The relative shares of gas utilisation can be seen from Table 4.

In the late eighties, further new gas discoveries, both on shore and off-shore and spread over different parts of the country, made it imperative for a fresh look at the gas utilisation scenario. Another Inter-Ministerial Group was set up to examine different possibilities of gas utilisation in the next 10-15 years. The Group recommended the following possibilities based on production capability of 30-33 billion cubic meters by 1994-95.

1. At least two, if not more, new fertiliser plants of 1350 tonnes of ammonia each;
2. 5000 MW or more of power generation;
3. About 4 million tonnes of sponge iron production;
4. 3 or 4 new Petrochemical Complexes;
5. Corresponding production of liquefied petroleum gas;
6. Commercial use of compressed natural gas in the transport sector.

In the fertiliser sector, future addition to nitrogen capacity will necessarily have to be based on natural/associated gas being the most preferred hydrocarbon source, supported by sufficient availability from different parts of the country wherein oil/gas reserves have been successfully identified. Hydrocarbon extraction plants may be set up to extract higher hydrocarbons for petrochemicals and methane rich gas would be quite suitable for ammonia plants. This will be the only rationale for optimum utilisation of this valuable natural resource.

Table 2  
INSTALLED CAPACITY OF NITROGEN ACCORDING TO SOURCES OF FEEDSTOCK

Year	Naphtha	Natural gas	Fuel oil	Coal	Coke/Coke oven gas	Lignite	Elect. power	External ammonia
1950	--	--	--	--	92.8	--	7.2	--
1960	--	--	--	--	99.2	--	0.8	--
1965	43.5	--	--	--	30.3	12.2	14.0	--
1970	65.3	10.2	--	--	13.3	5.2	6.0	--
1975	73.2	13.7	--	--	7.3	2.7	3.1	--
1980	51.7	13.0	19.6	9.9	1.4	--	1.7	2.7
1985	42.5	24.0	19.8	7.7	1.3	--	1.3	3.4
1987	35.3	34.1	16.6	6.4	1.3	--	1.3	5.0
1989	30.5	41.0	14.4	5.6	0.9	--	0.9	6.7
1994	24.8	51.5	13.5	4.4	0.4	--	0.4	5.0
(Estimate)								

## Higher capacity utilisation of gas based plants

The important feature discriminating the eighties from the earlier phases is the remarkable improvement in the production performance of the industry. Between 1980-81 and 1988-89 the overall capacity utilisation increased from 53% N to 85% N. While there has been a general improvement, the recent gas based plants commissioned in the eighties have achieved a very high operating factor. Feedstockwise share in production and capacity utilisation of N is shown in Table 5.

## Impact of feedstock on energy consumption

The search for better feedstock and process technologies together with improved operation and maintenance practices, scaling up of the size of the plants, removal of equipment and design deficiencies and installation of captive power plant etc., have resulted in considerable improvement in energy consumption for a highly energy intensive industry such as fertilisers. The average energy consumption for ammonia production in India has come down over the years from 14.8 in 1979-80 to 11.55 million k.cal in 1988-89 (Table 6). While this is higher than the world average at 9.3 million k.cal/te, the same should not be isolated from the fact that nearly 80% of world ammonia production is based on natural gas which is distinctively a better feedstock. By contrast, in India, a substantial share of the capacity continues to be based on naphtha besides coal and fuel oil. This apart, the fact of a number of chronically sick units in the public sector historically suffering from various design and equipment deficiencies, should also not be ignored. If only one considers the gas based plants to ensure a meaningful comparison, the average energy consumption in India during

1988-89 was 9.5 million k.cal. which is quite close to world average. Improvements in energy consumption based on various feedstocks is shown in Table.7. The energy efficiency of Indian ammonia industry can be further improved by increasing the share of gas based capacity, adopting latest technology and modernisation of older plants. The projected energy consumption by the end of 8th Plan (1994-95) based on Working Group recommendation is indicated in Table 8.

## Conclusion

The fertiliser industry in India has grown rapidly using a large variety of feedstocks putting us into a situation of near self-sufficiency in fertiliser availability and consequent foodgrain production. Besides, creation of additional capacity commensurate with growing needs, package of improvement measures including rehabilitation, modernisation, retrofitting, revamping and installation of captive power plants etc., are required to optimise production and energy consumption from existing plants. Integrated energy planning reflecting various social and economic parameters as also the choices within the energy sector would be necessary in the context of the changing scenario so that optimum results are obtained from the available energy resources.

There has to be greater emphasis on improved process technologies, medium and large size fertiliser plants and search for new and better products consistent with the emerging resource/infrastructure scenario as also to improve the efficiency of fertiliser use in maintaining our march toward self-reliance in fertiliser availability so vital to increasing agricultural production to meet the requirements of a growing population.

Table 3  
RECOMMENDATIONS FOR GAS UTILISATION

Group & Year	Recoverable gas reserves (billion cu.m)	Recommendations
1st Group 1976	87	4 Fertiliser plants to be set-up
2nd Group 1979	265	a. In addition, 5 Fertiliser plants to be set up b. Gas crackers & LPG extraction plants to be set-up
3rd Group 1984	475	In addition to fertiliser plants 3 power stations of total 1500 MW Cap. to be set-up

Table 4  
RELATIVE SHARE OF POWER & FERTILISER SECTOR FOR GAS UTILISATION

Year	Power	Fertiliser	Others
1970-71	40%	29%	31%
1979-80	31%	45%	24%
1986-87	29%	47%	24%

Table 5  
FEEDSTOCKWISE SHARE IN TOTAL CAPACITY AND PRODUCTION, WITH  
CAPACITY UTILISATION OF N

Year	Gas	Naphtha	Fuel Oil	Coal	Others (Elect/COG/Imp)
<b>1986-87</b>					
Capacity	32.9	32.9	17.1	6.6	7.1
Production	34.6	38.8	17.1	3.2	5.7
Capacity Utilisation.	83	84	82	38	73
<b>1987-88</b>					
Capacity	34.1	35.3	16.6	6.4	7.6
Production	40.2	31.8	19.0	2.5	6.5
Capacity Utilisation	92	70	88	31	67
<b>1988-89</b>					
Capacity	41.0	30.5	14.4	5.6	8.5
Production	43.1	31.4	15.4	1.5	8.6
Capacity utilisation.	95	84	88	33	85

Table 6  
ENERGY CONSUMPTION FOR AMMONIA PRODUCTION IN INDIA

Year	Cap. Utl.	Energy consumption (mill. K.Cal/te ammonia)
1979-80	66	14.8
1982-83	67	14.0
1985-86	72	13.6
1986-87	79	12.6
1987-88	78	12.4
1988-89	85	11.55

Table 7  
Energy consumption based on feedstock used

Feedstock	% C.U.	1986-87	% C.U.	1987-88	% C.U.	1988-89	Avg. energy consp. mill K.Cal/te
		Avg. energy consp. mill K.Cal/te		Avg. energy consp. mill K.Cal/te		Avg. energy consp. mill K.Cal/te	
Gas	83	10.05	92	9.56	95	9.52	
Naphtha	84	12.35	70	13.32	84	12.30	
Fuel Oil	82	14.44	88	13.74	88	13.75	
Coal	38	32.99	32	31.50	22	32.2	

Table 8  
Projected energy consumption for 1994-95

Feedstock	Capacity (mill. te 'N')	% C.U.	Est. prodn. mill te NH <sub>3</sub>	% prodn share in total	Est. Energy consumption mill K.Cal/te
Gas	4.622	95	5.35	55.8	8.7
Naphtha	2.607	85	2.70	28.2	12.0
Fuel Oil	1.264	85	1.31	13.7	13.5
Coal	0.456	40	0.22	2.3	27.0
Wt. Avg. 87.7% C.U. 10.7 mill K.Cal/te NH <sub>3</sub>					

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## INTRODUCTION

The ability of engineering plastics to replace metals has been the fundamental stimulus behind the global growth experienced by this family of polymers in recent years. A global market of more than 3 million tonnes has been generated and the on going replacement of metals underpins much of the growth still confidently anticipated.

In many cases, the well known properties of plastics such as lightness, mouldability and design framework have rendered them ready made substitutes for metals. But in others, a great deal of complex development work has been required to enable plastics to perform as required.

The host of bearings, gear wheels, bushes and other internal components of business machines, etc. for example, present an apparently ideal outlet for engineering plastics. Yet, full exploitation of potential of plastics for these and many other roles has depended on skillful development work.

Poly tetra fluoro ethylene (PTFE) one among the engineering plastics family was the first fluoro polymer developed accidentally by Roy J. Plunkett while working as research chemist in E.I. Dupont in 1938. PTFE has since been serving many of the stringent conditions of engineering industry by virtue of its unusual properties such as high crystalline melting point, stability above melting point, low dielectric constant, minimum dissipation factor, low coefficient of friction, resistance to almost all chemicals. Besides it is non-toxic and non-flammable and has low water absorption and non-stick properties.

The combination of these properties have contributed to the versatile application of this engineering plastic — PTFE, in Chemical, mechanical, electrical and electronic industries besides finding application in space research and atomic energy. The versatile properties of PTFE are further selectively improved by blending with fillers such as glass fibre, graphite, carbon, asbestos, metal powders etc.

PTFE is produced by a number of manufacturers in the world such as Dupont, ICI, Hoechst, Montefluos and Daikin. It is also reported that PTFE is produced in Poland, Russia and China.

In India, M/s. Hindustan Fluorocarbons Ltd. a subsidiary of M/s. Hindustan Organic Chemicals Ltd. has set up a plant

to produce 500 MT of PTFE per annum at Rudraram about 40 KM from Hyderabad. The plant started commercial production in March 1988. The product is marketed under the brand name HIFLON. This plant produces granular grades, dispersion grades, filled grades and fine powders of PTFE.

## VERSATILE PROPERTIES OF PTFE

- Total resistance to virtually all chemicals including oxidizing acids and solvents.
- High thermal stability — It retains its useful properties in a temperature range of  $-200$  to  $260^{\circ}\text{C}$ .
- Non-adhesive and excellent anti-stick properties.
- Lowest coefficient of friction for any known solid material and therefore, self lubricating.
- Low dielectric constant and dissipation factor, hence excellent electrical insulation properties.
- High weatherability and non-ageing.
- Not wetted by water — no measurable water absorption.
- Low permeability to gases.
- Non-toxic, non-flammable.

By virtue of these unique properties which cannot be matched by any other plastic, PTFE is truly "The Polymer of the Century".

## PROCESS TECHNIQUES

The processing of PTFE is more attuned to powder metallurgy. This is because of its very high melt viscosity. The technique adopted for processing PTFE consists of three stages — preforming by moulding at room temperature, sintering and then machining to the required shape. The moulding and sintering stages form a very important stage on which the characteristics of the end product depend.

## BASIC PROCESS METHODS

### Compression Moulding

Compression moulding is carried out on a vertical hydraulic press. The mould is of carbon steel in which PTFE granular powder is poured between two ram pushes. The PTFE powder is compacted using the hydraulic press. Since PTFE has a compression ratio of 4:1, it becomes essential for the press to have sufficient daylight. The pressure required for compacting PTFE varies from  $150\text{ Kgs/cm}^2$  to  $500\text{ Kgs/cm}^2$ . On completion of compaction, the preform is

removed with great care and sent for sintering. The sintering temperature ranges from room temperature to 380°C and is gradually cooled so as to obtain maximum crystallinity. The component obtained is sent for machining to desired shapes on a lathe machine.

### Automatic Moulding

This is a modified version of compression moulding to manufacture large volumes of simple parts from virgin and filled grades of PTFE.

PTFE is generally discharged volumetrically into the mould cavity from an overhead hopper via vibrating feed system. The press is equipped with an ejection system whereby the moulded part can be automatically lifted from the cavity and deposited on a conveyor system for sintering and cooling. It may be noted here that large volumes are needed for justifying this technique.

### Ram Extrusion

Ram extrusion process is a repetitive compression process. PTFE powder charges are compressed one above the other while the compressed material is forced down the die tube for sintering and cooling. By this method continuous length of rods and annular tubes are manufactured. These are subsequently machined to various shapes.

### Isostatic Moulding

While compression moulding is suitable for moulding of simple shapes of uniform cross section, isostatic moulding is suitable for moulding intricate shapes from virgin and filled grades of PTFE. In isostatic moulding uniform hydrostatic pressure is applied on all sides simultaneously. The pressure is transmitted for a hydraulic fluid via a flexible membrane suitably shaped to reflect final shape of the product. The product once compacted is sent for sintering and cooling. This process is generally adopted for high quality complex shapes.

### Paste Extrusion

Paste extrusion is used for manufacture of thin walled tubing, thick walled tubing, wire coating, unsintered tape and rope gasket. In this process, PTFE fine powder is mixed with the lubricant such as kerosene/MTO. If necessary, a variety of pigments and fillers are added. This mixture is compacted at a low pressure using a cylindrical die. The preform so obtained is placed in the cylinder of the extruder and pressure applied on the preform causing it to pass through the die orifice. The lubricant within the extrudate is evaporated by heat treatment. Thereafter the extrudate is passed through a pair of calender rolls to spread the cord into an even tape

in case of unsintered tape. In case of tubes the extrudate is in the shape of annular tube. The tube is inserted into a pipe and sent for sintering. In the case of wire cable, the preform is extruded on to the wire conductor.

### Dispersion Coating

The coating of metals and other substrates with PTFE for non-stick applications has brought PTFE and some of its more prominent trade names into almost every household.

Dispersions are usually applied at ambient temperature and sprayed on to a thoroughly cleaned substrate. This coating is sintered at 80°C. Subsequently the top coat is applied and sintered at 420°C.

PTFE liquid dispersion is also used for coating/improvement of glass cloth, asbestos, ceramics, etc. This is carried out by dip coating process.

## THE APPLICATION SPECTRUM

PTFE characteristics being so unique as already stated, find applications in a very wide spectrum of areas covering chemical, mechanical, electrical and electronic industries besides domestic applications.

### Chemical Industry

- Valve seats, valve lining, vessel lining, nozzles, expansion bellows.
- Packings such as asbestos rope with PTFE.
- Over braided hose (highly corrosive liquids).
- Thread sealant tapes.
- Gaskets, 'O' rings, 'V' rings.
- Lined pipes, fittings and equipment.
- Pumps.

### Mechanical/Engineering Industry

- Bearings.
- Bearing plates.
- Piston rings, piston rod packings.
- Shaft sleeves, bushes.
- Gaskets.
- Seal tape/rope.
- Pump parts.

### Electric Industry

- Circuit breaker nozzles.
- Circuit breaker parts.
- Cables.

PTFE laminated sheet, etc.  
Bushes.

### Electronic/Communication Engineering

- Cables.
- Computer wires.
- Co-axial wires.
- Copper clad PTFE for microwave application.

### Miscellaneous

- Kitchenware, packaging, food and plastic industries, textile, paper, rubber industries and refrigeration engineering.

## PRESENT SCENARIO

### Indian Scene

Processing of PTFE was done for the first time in India in early 1960. Since then PTFE consumption in India has grown albeit slowly to about 300 TPA today. There are about 108 companies processing the above quantity of resin in India. Majority of them are located in Western region and are basically small scale entrepreneurs.

In addition to PTFE resin, substantial quantities of components are being imported as spares and part of plant and machinery.

Development of various PTFE processing techniques in India has not kept pace with the world developments especially in the field of electronics, electrical, construction and microwave applications. Even in the chemical industry, where maximum quantity of this resin is used, the bulk of consumption is in packings, gaskets, thread sealant tapes and valve seals. While applications like lining pipes, valve lining has just been introduced in our country last year, applications such as pumps, lining vessels, columns, etc. which are in vogue abroad are yet to be taken up in India.

The non-availability of PTFE indigenously had been a formidable hurdle in developing PTFE applications in India. Now with indigenous availability of HIFLON material, the development of applications is on a fast track. Today HIFLON resins have captured 80% of the indigenous market share. HIFLON has been accepted as a material of international quality and has been exported to countries like USA and Canada. We are also getting more enquiries from Countries like US, West Germany and other European countries. Even though the Indian PTFE resin is well accepted abroad, the quantum of PTFE components for export is negligible. Most of the PTFE components manufactured by the processors are meeting the indigenous requirements.

### International Scene

The largest PTFE resin manufacturing capacities are located in highly industrialised economic regions of the World. In Western Europe, PTFE is manufactured by Du Pont, Hoechst, ICI and Montefluos. In the USA, Dupont and ICI. In Japan, ICI, Daikin and Du Pont. There are further capacities in China, Poland and USSR which mainly cover their local demand. Besides, Hindustan Fluorocarbons Ltd in India joined this elite group in 1988. The major PTFE consumption is also confined to countries like USA, Western Europe and Japan.

The total PTFE resin capacity in industrialised countries is around 37,900 tonnes per annum. The total world production capacity amounted to 43,000 tonnes by 1989. The world consumption at present stands at around 40,000 tonnes per annum. At present, various raw material manufacturers are planning capacity increases from the beginning of 1990. The average increase in consumption of PTFE in the industrialised world is about 5 - 8% annually. PTFE capacities will continue to enjoy the high level of utilisation at the beginning of 1990s. It is accepted that growth will be particularly more in countries such as Korea, Taiwan, Brazil and India.

### APPLICATION DEVELOPMENT CENTRE

The need for a centre which shall act as an interface between Hindustan Fluorocarbons Ltd., the manufacturer of PTFE resins in India on the one hand and the PTFE processors and ultimate consumers of the products on the other, has been recognised by HFL right from the beginning. This centre addresses itself to the following important tasks:

- a. Testing of PTFE resin.
- b. Testing of PTFE products.
- c. Guidance on PTFE processing.
- d. Trouble shooting and technical advice to processors.
- e. Exploring new fields of applications.
- f. Developing newer grades of PTFE especially composites with metal and other performance plastics.

Under the auspices of Application Development Centre Hindustan Fluorocarbons Ltd. has successfully developed import substitute items such as:

1. Nozzle head for SF-6 circuit breaker.
2. Components for defence equipment.
3. Etched PTFE sheet for bonding.

These are a few of the import substitute items successfully developed by HFL besides many others.

## EXPORT PROSPECTS

As already stated, the present total Indian requirement of PTFE resin is around 300 tonnes per annum, whereas HFL has set up a plant to manufacture 500 MT of PTFE per annum. This leaves a surplus of 200 TPA. HFL proposes to allocate 100 MT of PTFE resin for indigenous development for import substitute items. The balance, 100MT is proposed to be exported to various countries.

PTFE items manufactured indigenously are of very good quality comparable to those manufactured abroad. In spite of this, the quantum of PTFE finished product export is negligible. The main reason for this could be the Indian processor's satisfaction in selling his product indigenously for immediate realisation on their produce whereas there is a substantial demand for PTFE machined components for export. In India with its low labour cost, it should be possible to export PTFE finished items at internationally competitive prices. Some of the potential items for export are:

- a. Skived PTFE tape in varying thicknesses which finds application in electrical and electronic industries. These tapes are normally used in their virgin form or etched.
- b. Machined components for SF-6 circuit breaker.
- c. Nozzle heads in SF-6 circuit breakers of capacity 145 KV, 245 KV and 400 KV.
- d. Pump parts.

## CONCLUSION

PTFE polymer is relatively costly. It must be emphasised that this fluoro polymer should be judged not by the cost per unit weight, but by the cost of the job this polymer performs. The real value of avoiding breakdowns and subsequent production loss, value of reliability of various systems should be the basis of evaluating the relative economic merits of alternative materials for construction. It is this realisation that had eventually proved to be the crucial deciding factor in the rapid development of PTFE applications abroad. We, in India, are in the process of appreciating this concept of thinking.

The present manufacturing facility in India is resilient enough to take care of the higher demand of PTFE resin should be called upon. Now, it is for the entrepreneur to make use of the facilities available with HFL and explore the possibilities of developing newer applications of PTFE in India and for exporting the finished components of PTFE. There is definite price competitiveness for export of PTFE processed components. However, it is necessary to adhere to the following principles of:

- a. Quality management.
- b. Customer service.
- c. Near perfection.
- d. Delivery schedule for continued export.

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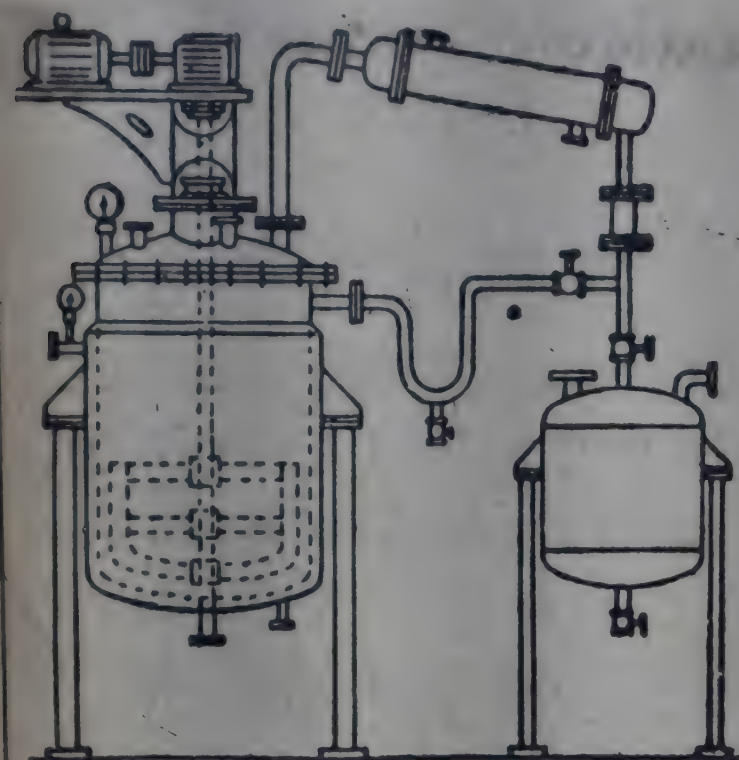
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## Biotechnology

### CETUS IL-2 THERAPY SUFFERS DOUBLE SET-BACK

The Californian biotech firm, Cetus, has suffered two blows to the development of its genetically engineered interleukin-2, Proleukin. The FDA's decision not to recommend Proleukin for the treatment of metastatic renal cell carcinoma (kidney cancer) followed soon after clinical work on the drug's antihypertensive effects was suspended, pending validation of the preclinical results.

Cetus says it is disappointed with the FDA's biological response modifiers advisory committee decision not to recommend its application for a product licence for kidney cancer. The company was awarded orphan drug status for this indication in 1987, and Proleukin is already approved in nine European countries. Clinical trials have shown that IL-2 produces significant and lasting responses, providing benefit to about 20% of kidney cancer patients, Cetus says. It adds that, in common with most anticancer agents, IL-2 has many side-effects but these are predictable and manageable and reverse once the therapy is concluded.

The enrolment of new patients in the phase I clinical development of Proleukin for treating hypertension was suspended because independent scientists have been unable to repeat the original preclinical results upon which the trials were based.

In January, researchers at the Masonic Medical Research Laboratory, in Utica, New York, writing in the journal *Hypertension*, reported encouraging results for IL-2 as a potential hypertension treatment in a rat model. Based on this, human clinical trials were started. However, these have not progressed sufficiently to provide any information on efficacy. According to the company, the additional preclinical work is likely to

take several months.

### SCIENTISTS OKAY HEPATITIS DRUG

US Scientists have reported that Schering-Plough's genetically engineered interferon alpha-2b, Intron A, is a successful treatment for chronic viral hepatitis, which by coincidence followed an FDA recommendation that the same drug be approved to treat hepatitis C in the US.

Writing in *The New England Journal of Medicine*, scientists reported results from a multicentre placebo controlled trial of Schering-Plough's version of interferon. A sustained loss of viral replication (the disease is caused by a virus) was reported in over a third of patients suffering chronic hepatitis B. Moreover, in about 10% of patients on interferon, hepatitis B surface antigen disappeared from serum, the authors add.

Worldwide, the incidence of hepatitis is rising, according to Robert Spiegel, Schering-Plough's vice president of research. In Japan it has assumed 'epidemic' proportions. Sales of the drug surged to \$ 92 m for the first half of this year, compared with \$ 92m for the whole of 1989.

Schering — Plough's interferon alpha-2b, Intron A, is one of three versions of genetically engineered interferon alpha on the US market. Hoffmann-La Roche markets Roferon A and Wellcome sells Wellferon. Current indications are a range of rare cancers, such as hairy cell leukaemia and Kaposi's sarcoma.

### RECORD NUMBER OF UK SCRIPTS

The number of prescriptions issued in the UK last year — 436.2m or an average of 7.6 per head of population — has increased to an all time high, according

to the Association of the British Pharmaceutical Industry in its annual review.

The UK trade surplus in pharmaceuticals increased, although imports grew faster than exports (but from a lower base line). Imports advanced 21% to £1.06bn, in contrast with exports, which grew 16% to £2.016bn.

The value of pharmaceutical sales to the UK's National Health Service (NHS) was £2.6bn, up 9%. Expressed as a proportion of the total NHS cost, the figure was stable at the 1988 level of 10.3%.

Total R & D expenditure by UK pharmaceutical companies increased 12% to £817m, the report says. In addition, the pharmaceutical industry has outpaced other manufacturing sectors over the last nine years, according to the department of trade and industry's output index.

Taking 1980 as a base level of 100, the pharmaceutical output index for 1989 was 166, compared with an all-chemical industry figure of 143 and a manufacturing industry level of 124, the report says.

### IMMUNOLOGY LTD. RAISES £ 4.6M

Immunology Ltd., a Cambridge, UK-based biotech company formed in 1989, has raised £4.6m (\$8m) in the first round of venture capital funding.

Currently, Immunology has four major development programmes: an antibody-based product, which prevents acute graft rejection in kidney transplantation; an immunotherapy product for the treatment of cervical cancer based on the activation of the patient's cytotoxic T cells; a cervical human papilloma virus, and therapeutics for the treatment of inflammatory bowel disease based on the modulation of activated T-cells.

## Environment

### NUCLEAR CUTS MAY HALVE SWEDISH CHEMICAL OUTPUT

Production in the Swedish chemical and steel industries could more than halve by the year 2000, if plans to accelerate the decommissioning of the country's nuclear power plants go ahead, warns a new report from the Federation of Swedish Industries. The report, *Sprang i blindo* (Leap in the dark), says the resulting increase in the price of electricity, combined with environmental legislation to cut emissions of sulphur dioxide, carbon dioxide and nitrogen oxide would lead to the closure of many industries and factories and impair international competitiveness.

Sweden had planned to decommission all 12 of its nuclear power plants by 2010, but, following the accident at Russia's nuclear power plant at Chernobyl, the government is now discussing plans to accelerate the decommissioning programme with the closure of two plants by 1996. The 12 plants provide half of Sweden's total electrical supply today. If the effect on production of environmental legislation to curb emissions is also taken into account, the closure of two nuclear power plants would result in a 57.7% drop in production for the chemical and steel industries from 1985 to 2000, the report predicts; the closure of 10 nuclear power plants would cause a 77.3% drop in production. The three main goals of Swedish environmental legislation are to reduce sulphur dioxide emissions by 65% from 1980 to 1995; to limit carbon dioxide emissions to no higher than 1988 levels, and to halve nitrogen oxide emissions between 1980 and 2000.

Dr. Dick Kling, author of the report and economist at the Federation of Swedish Industries, said: 'We feel that early decommissioning of nuclear power plants combined with emissions control, would drastically impair industry's competitiveness, and with only

minimal environmental benefits'.

He added: 'We can accept both the closure of nuclear power plants and the control of emissions, but only if there are tax reductions or some other refunding systems for industry, so that they can improve the environment and still compete with other countries. The other alternative is if other countries are under the same legislation and so under the same financial pressure'.

Kling said there has been no official government response to the report: "The feeling is that the government accepts our estimates of the effect on industry of nuclear power plant closures and is looking for answers to the problem. Until now we have not seen any willingness to introduce tax reductions for industry to make up for losses due to environmental legislation, but I do not think it is impossible'. Uncertainty over the future of Sweden's electricity supply has already been cited by one Swedish chemical firm —Eka Nobel — as the reason for locating its new 50,000 tonne/year sodium chlorate plant in France.

### DoE POLLUTION SYSTEM READY

A new timetable for the UK government's integrated pollution control (IPC) system has been released. The revised timetable incorporates the recently announced three-month delay to the start of its phasing-in programme for IPC. The programme will now take five years to complete instead of the planned four, as most existing plants will not join IPC until April 1992. New plants and substantial modifications to existing plants will enter IPC from 1 April 1991. Large combustion plants will also enter on this date.

A Department of Environment statement issued with the new timetable said the government now aims to issue drafts of all regulations required to implement

IPC in early October. The regulations will come in force by 1 April 1991. The statement says the first batch of guidance from Her Majesty's Inspectorate of Pollution, covering the five main industry sectors, is nearing completion and will be issued for consultation in mid-September. It will be issued in final form at the beginning of January 1992. The government will also be issuing general guidance on how IPC works in January. IPC forms the core of the government's Environmental Protection Bill, which is still being debated in the House of Lords. A spokesman for the DoE said the revised timetable will give more time for consultation with industry. He said: "We can discuss some of the worries companies have about the way we intend to operate IPC, for example how plant inspections will work'.

### PCBs SURVEY AT RECHEM WELSH PLANT

The UK government has commissioned an independent scientific survey to determine the levels of PCBs around the Rechem hazardous waste incineration plant at Pontypool, Wales. The decision to carry out an independent study follows a disagreement between Rechem and both the Welsh Office and Torfaen Borough Council over the PCB levels reported in their tests on vegetation and duck eggs gathered from the area surrounding the company's site. David Hunt, secretary of state for Wales, announcing the survey, said: "We have come to the conclusion that the best way of resolving this uncertainty is to arrange for an independent survey of PCB levels by suitable scientific institution." The survey will be designed by Professor Lewis Roberts who is Wolfson professor of environmental risk assessment at the University of East Anglia, England. Alan Woods, community liaison officer for Rechem, said the company is happy to have an independent assessment of PCB levels and will cooperate fully with the survey.

## Technological Scene Abroad

### KELLOGG TO GET SOLE USE OF PHENOL/ACETONE LICENCE

US engineering company, MW Kellogg, is about to receive the worldwide exclusive licence from Hercules-BP Chemicals to build plants using their phenol/acetone manufacturing process.

A spokesman for Hercules Licensing Group in Wilmington, Delaware, US, confirmed that negotiations with Kellogg are very near completion and new customers would now be referred to Kellogg. A number of potential customers have been lined up for the process, most of them in Europe and some in the Far East.

In the last two years, there have been no new sales of the process, but expansions of existing plants have been carried out. Previously, Kellogg shared the licence with Japanese contractor, Mitsubishi Petrochemical.

Hercules-BP Chemicals plans to

upgrade the 32-year old process, although no details of planned changes are available yet.

The process, which oxidises a cumene feedstock to produce phenol and acetone, is now in use in 30 plants around the world, ranging in size from around 7,000 to 227,000 tonne/year.

The process, which boasts high yields with low energy consumption, is carried out in four steps:

(a) Liquid cumene is oxidised in air to cumene hydroperoxide — an exothermic reaction.

(b) The cumene hydroperoxide is then concentrated by vacuum stripping in a number of stages to separate water, cumene, cumene hydroperoxide and by-products. The cumene is recycled.

(c) An acid catalyst then cleaves the cumene hydroperoxide to form phenol and acetone in an almost instantaneous, highly exothermic reaction.

(d) The cleaved mixture is then separated into acetone and phenol.

### LIGHTNING THREAT TO PLANT SAFETY

Chemical and process companies may think they have themselves covered in case of lightning strikes, but while conductors will protect their buildings, computer networks can be crippled and operators could lose control of plants, the UK Atomic Energy Authority (UKAEA) warned.

A UKAEA statement said: 'As automation has taken over, computers have been designed to control very complicated processes and undertake safety functions. With the control system down, the plant could become highly unstable'.

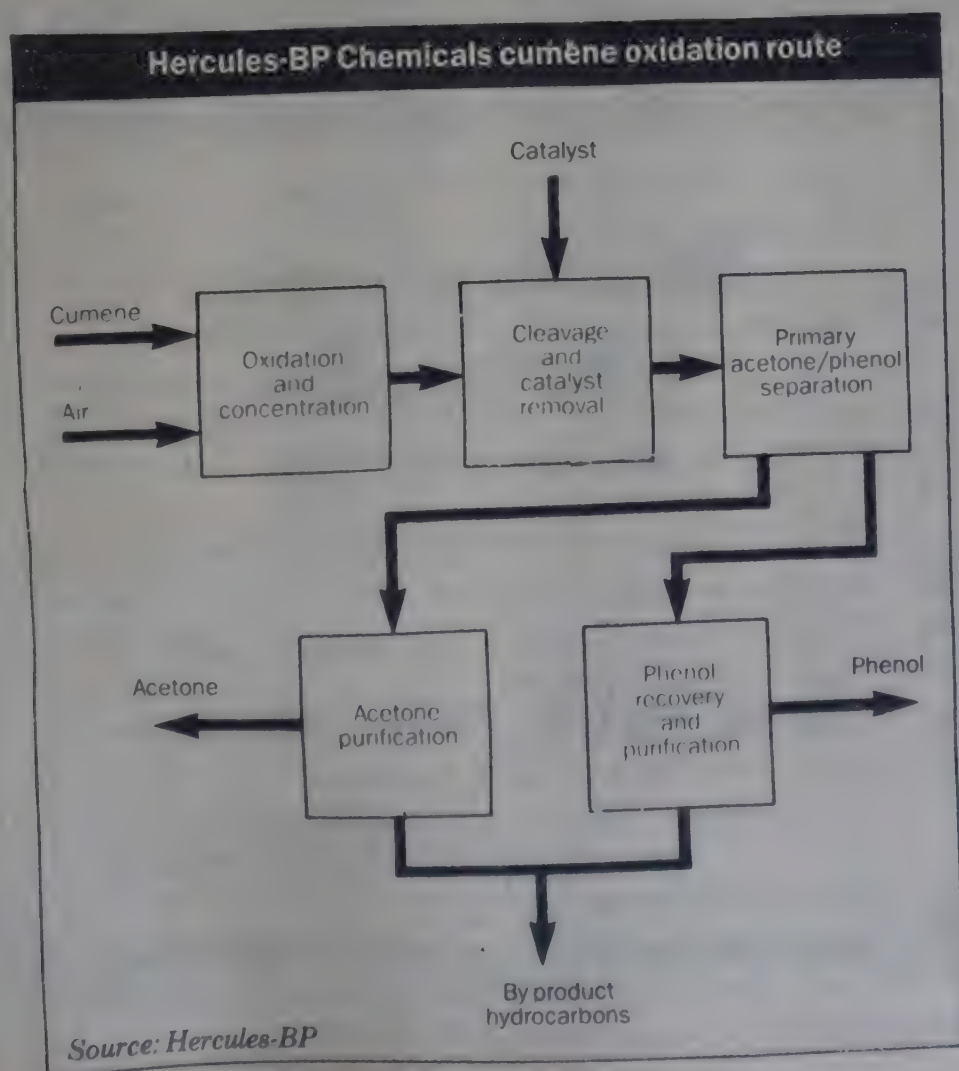
Research at the Culham lightning centre, UK, one of three such centres in Europe, explained that when lightning passes through the conductor and is channelled to earth, the building's electrical potential can be raised by several hundred thousand volts. This lightning surge finds an easy path through computers, network cables, crippling computers, destroying network lines, and even injuring operations.

The UKAEA blames the setting of BS6551 for lightning conductors, which sets specifications for protecting the building, but not electrical systems.

### GENETIC GO-AHEAD

Grunenthal has received permission to build a DM40m (\$25.3) production plan for the genetically engineered thrombolytic pro-urokinase near its research headquarters at Aachen, West Germany.

The project, which was delayed by environmental protests, is the first to be approved under West Germany's new framework law on genetic engineering. The 'greens' in the state parliament of North Rhine-Westphalia have said they will appeal against the decision.



The plant will use E Coli to manufacture the company's cardiac drug, sold under the tradename Saruplase.

Meanwhile, W. Germany's chemical employees union, IG Chemie-Papier-Keramik, has demanded that the federal government's genetic engineering law should be applied to projects in East Germany as soon as possible. Take-up of the West Germany standards would provide potential Western investors with reliable conditions for establishing biotechnology facilities in East Germany.

#### LE CARBONE LAUNCHES PER-VAPORATION UNIT

Le Carbone (GB) has announced the UK launch of its PV separator pervaporation process for the recovery of organic solvents. The company has installed 22 pilot pervaporation units and 24 industrial scale plants in 10 countries so far, claiming it as a highly energy-efficient process, with typical pay-back times of less than 12 months.

Le Carbone says pervaporation is more environment friendly than azeotropic distillation as a solvent recovery process because it does not require an entrainer, such as benzene. Also, in the pervaporation process, only the minor component has to be evaporated and this makes it much more energy efficient.

The modular PV separator is available as a complete skid-mounted industrial scale plant or on a smaller scale as laboratory and pilot test units. The smallest industrial installation so far has a capacity of 250 litre/day of isopropyl-alcohol.

At the largest Le Carbone installation, at Bethenville, France, the pervaporation unit produces 90,000 litre/day of ethanol, with production concentration of 99.95% from feed at 96.3%. The plant has an energy demand of 0.237 Kwh/litre at 99.95% concentration, using a pervaporation membrane of over 2000m<sup>2</sup>.

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## News About New Projects

### SHELL/MITSUI TOATSU STUDY EUROPEAN MDI JV PLANT

Shell International Chemical and Mitsui Toatsu are to undertake a feasibility study for the joint manufacture of the polyurethane intermediate diphenylmethane diisocyanate (MDI) in Western Europe.

If the plans receive board approval as expected early next year, construction of a 50,000 tonne/year plant would begin as soon as possible for start-up by the end of 1993.

Costs are estimated at around \$200m. The location has yet to be decided: a Shell spokeswoman said 'several' sites were under consideration.

The 50:50 joint venture is seen to combine the complementary strengths of Shell's European marketing expertise and Mitsui Toatsu's MDI technology. The products would be commercialised independently by Shell and Mitsui companies.

Shell has a strong European position in polyether polyols, the other key polyurethane ingredient, but is a smaller player in the isocyanates business.

It has a 50:50 joint venture with Bayer in Antwerp, called Bayer-Shell Isocyanates, which uses Bayer technology to produce 36,000 tonne/year of MDI and 30,000 tonne/year TDI.

A Shell spokesman said any joint venture with Mitsui would not affect the company's relationship with Bayer.

Mitsui Toatsu is a leading company in the field of polyurethane intermediates, producing 55,000 tonne/year of MDI and 62,000 tonne/year of TDI at Omuta, Japan.

It is also studying plans to build a 40,000 tonne/year plant in South Korea

in a joint venture with Kumho Petrochemical Industries.

### WESTLAKE SELECTS STYRENE SITE

Westlake Styrene, a newly-formed joint venture between Taiwan's Taita Chemical, BTR Nylex, Sumitomo Corp and the Westlake group, has selected Lake Charles, Louisiana, as the site for its previously announced styrene monomer plant.

Site preparation is now beginning for construction of the 160,000 tonne/year plant, which will be built by Badger Design & Constructors using Badger technology. Feedstock for the \$100m facility will come from Westlake Petrochemicals' 450,000 tonne/year ethylene cracker under construction by M W Kellogg at the same site. A spokesman for the Westlake group said construction of the cracker is proceeding on schedule for start-up in April 1991.

A major part of the styrene produced will be shipped to Taita's operations in Taiwan to meet existing demand for the production of ABS resins and general purpose, high impact and expandable polystyrene. Taita currently has capacity for 40,000 tonne/year of ABS and 60,000 tonne/year of polystyrene. The balance of production will be sold predominantly on the US domestic market, the company says.

### YASINTA DIVERSIFIES

P.T. Yasinta Poly, Indonesia's largest producer of polyester fibres, is diversifying into polyamide fibres production with the construction of a polyamide-6 plant at Tangerang, near Jakarta.

When complete in early 1992, the plant will produce 65 tonne/day of polyamide-6 chips for further processing into partially oriented filament yarn and fully drawn filament yarn. It will be one of the world's largest polyamide-6

plants of its kind, says Zimmer, making Yasinta the largest polyamide producer in Indonesia. Total investment will be around DM200m (\$125m). Zimmer's contract covers the polymerisation plant, a spin-draw-winding facility and a caprolactam recovery unit.

### AMOCO SIGNS INDIAN PTA LICENCE

Amoco of the US has signed a memorandum of understanding covering the supply of technology for the 200,000 tonne/year pure terephthalic acid (PTA) plant to be built for JK Synthetics at Saleempur, Uttar Pradesh, India. An Amoco spokeswoman approval is currently being sought from the Indian government.

JK Synthetics had originally tied up with UOP to build the whole of the aromatics complex planned for Saleempur. The plan called for production of 100,000 tonne/year benzene; 108,000 tonne/year paraxylene (for conversion to 150,000 tonne/year PTA); 35,000 tonne/year orthoxylene and 50,000 tonne/year cyclohexane. Startup was originally scheduled for the last quarter of 1992. Total cost was to be Rs. 12.5bn (\$731m). A new company, JK Petrochemicals, was set up to manage the project.

Although JK Petrochemicals is understood to have signed a memorandum of understanding with UOP covering technology for the whole aromatics plant, reports from India suggest Amoco is now insisting it should replace UOP. Neither Amoco nor UOP would comment on this rumour.

### CONTRACTORS COUNT COST OF IRAQ'S INVASION OF KUWAIT

The deepening crisis in the Gulf area following Iraq's invasion of Kuwait will have severe repercussions for the international contracting industry. With communications lines down and move-

ments in and out of Iraq severely restricted, contractors, like the rest of the international business community, were struggling to assess both the immediate and the longer-term effects of president Saddam Hussein's sudden offensive.

The primary concern for US contractor Lummus Crest and Italy's Snamprogetti was the safety of personnel stranded in Iraq. The longer-term effects of the United Nations trade embargo on ongoing projects and future business with Iraq can only be guessed at. As early as Aug. 2nd the US government had prohibited the export to Iraq of 'any goods, technology (including technical data) or services from the US', and had stopped US companies from carrying out work on Iraqi projects, whether industrial or governmental.

Following the end of the Iran/Iraq war, Iraq had been predicted to be the scene of massive petrochemical activity over the next decade, with major ambitions based on its oil and gas reserves. At the time of the invasion, Lummus personnel were on site at Iraq's first petrochemicals complex at Basrah, close to the Iranian border. Snamprogetti said it had 20 people in Baghdad working on the final stages of the east Baghdad oilfield, and a further 15 at Basrah, completing a lube oil plant or start-up this year.

Iraq's first complex at Basrah centres on a 130,000 tonne/year ethylene cracker and includes units for 66,000 tonne/year of VCM, 60,000 tonne/year of PVC, 11,800 tonne/year of chlor alkali and 30,000 tonne/year of hdPE. It was finally commissioned towards the end of last year, after lying idle for five years during the Iran/Iraq hostilities. Until last week, all units were understood to be running at full production capacity. A spokesman for Lummus, the projects' managing contractor, its start-up team had remained to provide training for the plant operators. Negotiations were also taking place on possible

expansions of the complex, believed to include addition of a low density polyethylene unit.

Work on Iraq's second petrochemicals complex, a \$2.5bn project at Mus-sayed, 50km south of Baghdad, is at the design stage with no foreign nationals understood to be on site. Managing contractor, Lummus, and fellow US contractor, UOP, which was to provide technology for a C4 olefins project at the site, both reported they had frozen design work on the project. The complex, for the Iraqi government agency Techcrop, was to be based on a 420,000 tonne/year Lummus-designed ethylene cracker. Phase I, which was to include downstream units as listed below, was due onstream by the end of next year. A second phase was planned for completion by 1993.

Plans were also being progressed for two new nitrogen fertiliser complexes to be set up in the Baiji area by a consortium of Kellogg, Hitachi Zosen and Nissho Iwai. Capacity at the site was being doubled to 2,000 tonne/day of ammonia and 3,500 tonne/day of urea. However, Snamprogetti's \$330m fertiliser complex at Khor al Zubair had not come into force because of failure to raise the necessary finance.

Technip had a letter of intent for construction of a \$550m grassroots nitrogen fertiliser complex at Al Qaim, but recently declined to comment on the situation. Simon-Carves reported that it had frozen engineering design work on its contract for a sulphuric acid unit at Al Quim, due for completion in late 1991.

Only Italy's TPL reported the presence of personnel in Kuwait, involved in the final stages of an oil purification project for Ameron. The recent focus of contractor attention has been Kuwait Petroleum Corp's (KPC) revised plans for a \$2bn complex at Shuaiba. Proposal called for a 750,000 tonne/year ethylene cracker with down-

stream units for lldPE/hdPE, monoethylene glycol, di- and tri-ethylene glycol, benzene, styrene monomer, polystyrene and aromatics production. At the time of the invasion, KPC was preparing documents inviting firms to offer technologies. In a separate project at the same site, KPC's subsidiary Petrochemical Industries Company (PIC) was planning a 100,000 tonne/year polypropylene plant based on the Unipol Carbide/Shell Oil (USA) Unipol process. Only two weeks ago, it had set November as the deadline for contractor bids.

Eleven contractor/consortia were understood to have prequalified: France's Spie Batignolles with Luck Engineering of South Korea; Mitsubishi Heavy Industries with Mitsui; Foster Wheeler Iberia with Daelim Engineering of South Korea; Brown & Root International with Hyundai Engineering & Construction; the UK's John Brown with CPS International of the US and Kuwait's House of Trade & Contracting Company; Bechtel; Toyo Engineering Corp; Jacobs Engineering; Italy's TPL; Snamprogetti; and Hitachi Zosen Corp with India's Southern Petrochemical Industries Corp and Jurong Engineering of Singapore.

**Planned units at Mussayed  
('000 tonne/year)**

Phase I			
EO	70 000	lldPE	160 000
EG	60 000	SBR	45 000
SAN	5000	Mono-	
PS	80 000	ethanolamine	15 000
Butadiene	70 000	MTBE	60 000
Butene-1	15 000	ABS	15 000
Benzene	115 000	PP	100 000
BTX	100 000	Styrene	145 000
DEG	5750	PO	15 000
TEG	265	PG	8000

Source: Techcorp

## JOHN BROWN AWARDED CONTRACT

Upjohn has awarded John Brown the construction management contract for its multi-purpose batch chemical synthesis plant being built at the company's existing Kalamazoo, Michigan site.

## News from Japan

### JAPAN, SAUDIS TO TIE UP FOR OIL-TECHNOLOGY RESEARCH

Japan plans to establish Japan-Saudi Arabia Oil Technology Research Center (tentative name) with the necessary funds provided by Japanese oil firms. The planned center will help Japanese and Saudi Arabian researchers to conduct joint research on oil exploitation and oil-refining technology.

The Japanese researchers will come from oil-developing firms, oil refineries distributors, universities, Japan National Oil Corp., and national research institutes, while their Saudi Arabian counterparts will be from Aramco and UPM. They will tackle two themes — one each for the upstream and downstream sectors — for five years at a cost of Yen 1,000 million in each case.

In a related development, an advisory committee aimed at selecting research themes and giving advice on the planned co-operative research will be formed with staff members coming from MITI, Japan National Oil Corp., Aramco, UPM and Petromin — Saudi Arabia's state-run oil corporation.

Japan is moving toward stepping up co-operation with Saudi Arabia — a major oil supplier for Japan — in overseas trade, investment and technology transfer.

### 5 MITSUBISHI GROUP FIRMS TO JOINTLY MANAGE ARISTECH (U.S.)

At the request of Mitsubishi Corp. four Mitsubishi group firms have invested roughly Yen 770 million each in Aristech Chemical Corp. (U.S.) of which Mitsubishi Corp. gained control last March: they have thus obtained 4.48% each of Aristech's stock, Mitsubishi Corp. had a 55.7% interest in the U.S. firm. The four are Mitsubishi Gas

Chemical, Mitsubishi Kasei, Mitsubishi Petrochemical and Mitsubishi Rayon.

Mitsubishi Corp. took over Aristech Chemical on the condition that the U.S. firms would be managed for three years by its executives now in service. The Japanese trading firm thus intended not to stimulate adverse U.S. public opinion.

On the other hand, it is difficult to build up the U.S. firm's business operations without co-operation from Japanese chemical producers, i.e., the four Mitsubishi group firms. They have so far, however, not given much active co-operation to the U.S. company, President M. Yoshida of Mitsubishi Petrochemical says: "We have invested in Aristech Chemical for social reasons".

To date the Mitsubishi group firms have sometimes competed with each other with their different business policies implemented independently. Their capital investment in the U.S. firm will help them tackle chemical operations in a concerted fashion.

Aristech Chemical is now showing a good business performance. With regard to its business operations in the future, President Y. Nagai of Mitsubishi Rayon says: "We would like into the actual conditions of Aristech's plants and scrutinize production technologies employed there". "We'll deliberately tackle Aristech operations since the U.S. firm has large business fields which are closely connected with ours", President M. Yoshida adds.

### HYDROFLUORIC ACID USABLE FOR 16M-DRAM PRODUCTION

Daikin Industries, Ltd., has succeeded in developing ultrahigh-purity hydrofluoric acid (trade name: SH-16) used for cleaning/etching 16M-DRAM chips, whose mass-production will be inaugurated around 1992. It is produced by removing impurities from 4M-DRAM-use hydrofluoric acid using a

0.05-micron PTFE filter.

The new product contains very little in the way of impurities — particles with a diameter of 0.3 micron or more, one or nil per 1ml; cationic (metal) impurities, below 1ppb; anionic impurities (phosphoric acid, etc.), below 5ppb.

The company plans to set up a mass-production line (output: 4,000 t/y) at a Yodogawa factory (Osaka Prefecture) by the end of next year. The new product will be priced at approximately Yen 1,000/kg when mass produced.

Impurities contained in hydrofluoric acid unfavorably affect IC devices and DRAM producers are calling for further raising of the purity concerned. The company has prevented impurities from leaking from recyclable HDPE containers for the new product. It is scheduled to commercialize surfactant-added hydrofluoric acid some time in the future.

### ETHYLENE EXPORTS TO TAIWAN TO BE REALIZED

Ethylene exports to Taiwan are to be realized at last: it will be the first time Japan has exported ethylene to the country. Idemitsu Petrochemical Co. will export ethylene to China General Plastic Corporation (CGPC; Taiwan) from July to September.

To cope with the ethylene shortage in Taiwan, CGPC constructed a tank capable of storing 10,000 kl of ethylene but construction of pipelines to plants has been delayed. Therefore ethylene importing is being hampered due to the use of road transportation.

Thus, with ethylene-plant construction plans being delayed and the operation rate of China Petroleum Corporation (CPC; Taiwan's) plant being low because of the plant's obsolescence, inquiries for ethylene imports are being actively received by Japanese manufacturers.

Idemitsu Petrochemical intends to export 2,000 tons of ethylene to CGPC during the July-September period. Showa Denko K.K. will also start supplying ethylene to Taiwan after reopening of plants shutdown for periodical inspection. The price of the Taiwan-bound ethylene will be the same as that of Korea-bound ethylene.

Showa Denko and Idemitsu Petrochemical have been exporting 160-170,000 tons a year of ethylene mainly to Korea for the past several years. Taiwan's ethylene-plant construction plans and ethylene-import build-up are being held up by environmental problems and the operation rate of existing ethylene plants is low due to plant obsolescence and shortage of natural gas. On the other hand, demand for ethylene derivatives is active. Therefore Taiwan's ethylene shortage is serious.

#### **SHARP INCREASE IN PTA CAPACITY EXPECTED FOR ASIA IN 1991-93**

Some Asian countries seem to be moving toward expanding production capacity for high-purity terephthalic acid (PTA) in response to brisk demand for use in polyester-fiber production. It is forecast that output of polyester fiber in Asia — 6 million t/y at present — will amount to 10 million t/y in 1995. PTA consumption in 1995 is put at 921,000 tons for India and Southeast and 3,056,000 tons for the Far East excluding Japan (832,000 t). Its consumption in Asia in the year will account for 65% of world consumption of the product itself. In Indonesia, Mitsubishi Kasei has decided to build a 25,000-t/y plant in a team-up with local interest. Mitsubishi Petrochemical Industries, Amoco Chemical (U.S.) and ICI (Britain) are conducting feasibility studies of PTA business in the same country. They will submit related investment plans to the authorities within the year.

Indonesia's annual demand for PTA is projected to reach 800,000 tons in

1994 or 1995 but domestic capacity is no more than 180,000 tons at present. Pertamina — Indonesia's state-run firm — plans to scale up the capacity to 225,000 tons next spring through debottlenecking.

ICI is scheduled to build PTA plants with combined capacity of 600,000 t/y in Thailand and Taiwan. Reliance Industries is implementing a plan for building a 200,000 t/y plant in India. To sum up, new PTA plants (capacity: 1.5 million t/y in total) will be put into operation in Asia from 1991 thru 1993. PTA capacity will be further expanded through scaling-up of capacity of existing plants.

S.Korea and Taiwan are endeavoring to raise their self-sufficiency rates for the product. The former will turn into a PTA exporter at the end of this year, while the latter's PTA imports will be halved to about 260,000 tons next year.

#### **PRICE HIKES FOR SYNTHETIC RUBBER AGREED ON**

Japan Synthetic Rubber Co. has reached agreement with Bridgestone Corp. and other tire producers with regards to price hikes for the synthetic rubbers it supplies. The agreement is effective for those supplied on and after July 1.

Prices for SBR and BR have been raised by ¥ 17-18/kg and ¥ 15-17/kg, respectively: the margins are equivalent to 70-75% of Japan Synthetic Rubber's target prices. The price of butyl rubber has been jacked up by ¥ 20/kg: it was upped ¥ 15/kg last fall. Prices for other types of synthetic rubber have been raised in accordance with the company's request.

The company attempted last April to boost synthetic-rubber prices on the grounds of increase in raw material/utility/distribution costs: it thereby intended to raise the prices to the international price level.

Bridgestone, for its own part, refused the request, claiming that the circumstances surrounding tire operations were getting severe along with the spread of globalization — this is symbolized by Bridgestone's take-over of Firestone (U.S.) — and it was difficult to pass proposed price increases on to car manufacturers. Price negotiations between the two sides, therefore, dragged on until recently.

Japan Synthetic Rubber is complaining that the agreed-on prices are still lower than the corresponding international levels. The company is scheduled to inaugurate price negotiations on synthetic rubber for use in paper production.

#### **CHUGAI TO MARKET AMERICAN DNA-PROBE REAGENT FOR MYCOPLASMA**

Chugai Pharmaceutical Co. will market in September a DNA-probe diagnostic reagent for mycoplasma causing pneumonia. It is the first reagent to be marketed in Japan among those developed by Gen-Probe Inc. of the U.S. which was taken over last November by Chugai Pharmaceutical. The reagent is also of the first DNA-probe type to be used in Japan for identifying mycoplasma for pneumonia.

It features substantially reduced measurement time. The diagnostic product mainly consists of a bacteriolytic solution, a probe solution, a control solution and a reaction tube. Tests so far conducted at seven or eight medical institutions throughout the country show a success rate of about 90% for determining the presence of mycoplasma with respect to positiveness and early 100%, with regard to negativeness, the company reported. While conventional methods require one month or so for measurement, the new method takes only two to three hours for detecting mycoplasma. This is done through the reagent's specific reaction to the ribosomal RNA of micoplasma.

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# MARKET INFORMATION

## Xylene shoots, petroleum based products to further increase

Prices of xylene shot up to Rs. 28 with the Gulf crises remaining unresolved. Prices of petroleum products are expected to firm further. Phthalic anhydride went up to Rs. 46.

Prices of plasticisers also went up.

In the intermediates section shortage of supplies pushed prices of cyanuric chloride to Rs. 170.

We cannot guarantee the accuracy of the prices published in CHEMICAL WEEKLY as they are based only on the enquiries made by our correspondent – and, as such they are not FIRM PRICES as between a buyer and seller. The prices are published only with a view to giving some ideas of the market conditions.

The prices are inclusive of Excise and Maharashtra Sales Tax.

(Prices as on September 24, 1990)

INDUSTRIAL CHEMICALS	Per Kg.				
Ammonium sulphate	2.50	Borax (Granular)	16.00	Cobalt oxide	550.00
Ammonium phosphate (Mono)	14.50	Borax (Powder)	22.00	Cresylic acid	62.00
Ammonium phosphate (Di)	14.50	Boric acid (Tech)	32.00	Camphor (Indian)	105.00
Ammonium carbonate (Di)	17.00	Bisphenol-A	75.00	Cream of Tartar (Tech.) China	70.00
Ammonium bicarbonate	6.00	Butyl carbitol	106.00	Citric acid (Belgium) (Resale)	47.00
Ammonium chloride	3.25	Caustic soda (Flakes)	11.00	Citric acid (Indian) (Resale)	41.00
Ammonium nitrate	6.00	Caustic soda (Solid)	12.00	Copper sulphate	25.00
Arsenic white powder	22+ST	Caustic soda (Lye)	10.00	Chromic acid	65.00
Acrylamide (Resale)	85.00	Calcium chloride 70% (Solid)	3.25	Ethylene urea	58.00
Barium carbonate	20.00	Calcium chloride 75-80%(fused)	3.50	Ferric chloride (Lumps)	9.00
Bleaching powder (33% Cl)	5.00	Calcium chloride 36% (Anhydrous)	5.00	Ferric chloride (Anhydrous)	20.00
		Calcium carbonate (precipitated)	6.00	Glue flakes	15.00
		Calcium carbonate (Activated)	5.75	Glue sheets	6.75
				Gohsenol GH-17	135.00
				Hydro	45.00



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DIACETONE  
ISOPROPANOL  
N-BUTANOL  
M.I.B.K.  
IPA-CBM

ISOBUTANOL  
E.D.C.  
2-ETHYL HEXANOL  
P.E.G. 200/300/400/600/1500  
M.E.G.  
D.E.G.

Please Contact: Authorised Distributors for Gujarat State.



## SHREE AMBICA TRADING CORPORATION

Bombay Office:

813, Raheja Centre, 214, Nariman Point,  
BOMBAY - 400 021

Phones: 240415/243979/2873680

Ahmedabad Office:

4A-B, Trade Centre, Near Stadium House,  
Ahmedabad-380 014

Phone: 462332/440084

Hyflosupercell	34.00	Sodium sulphide 58-60% (Flakes) (TCL)	25.00	Benzyl Alcohol	60.00
Hexamine (Resale)	34.00	Sodium sulphide pure (Flakes)	12.25	Benzyl Chloride	34.00
Industrial Wax	25.00	Sodium nitrite (Resale) per 50 kg.	1,300.00	Benzo trichloride	16.00
Litharge	40.00	Sodium chlorite 80% (Spain)	100+ST	Benzoyl chloride	22.00
Lead Acetate (Tech.)	39.00	Soda Ash (Tata)	5.00	Bromine Liquid	68.00
Lithopone	32.00	Soda Ash (Birla)	5.00	Chloroform	30.00
Magnesium chloride (Crystal)	2.00	Soda Ash (Imp.)	5.00	Carbon Tetrachloride	20.00
Menthol crystal (Flakes)	355+Ex+ST	Sodium bicarbonate	7.00	Cellosolve	65.00
Menthol bold	425+Ex+ST	Sodium bisulphite	8.00	Cyclohexanone	64.00
Menthol crystal cold	395+Ex+ST	Sodium silicate	5.50	Cyclohexanoid	58.00
Magnesium carbonate (Japan)	30.00	Sodium acetate	7.20	Diacetone (Resale)	26.00
Magnesium carbonate (Indian)	26.00	Sodium alginate	450.00	Diethyl Oxalate	34.00
Maleic Anhydride (Resale)	42.00	Titanium Dioxide (Anatase)	65.00	Diethyl glycol (DEG) (Resale)	38.00
Mercury (34.5 Kgs)	11,500.00	Titanium Dioxide (Rutile -- RCR <sub>2</sub> )	88+ST	Diethyl Phthalate	48.00
Nickel chloride	110.00	Tartaric acid	190.00	Diallyl Phthalate	42.00
Oxalic acid (Resale)	14.00	Trisodium phosphate	12.00	Dimethyl Phthalate	28.00
Peppermint oil (Rectified)	188+Ex+ST	Thiourea	78.00	Diethyl Adipate	52.00
Potassium carbonate (Indian)	28.00	Urea (Tech.)	3.00	Dibutyl Adipate	42.00
Potassium carbonate (Imported)	32.00	Vacuum salt	1.00	Dipentene	15.00
Potassium bichromate	38.00	Zinc Dust	52.00	Dimethylamine 40%	30.00
Potassium phosphate (Mono)	34.00	Zinc Oxide	58.00	Dimethylamine 50%	35.00
Potassium phosphate (Di)	25.00	Zinc chloride powder (Tech.)	20.50	Ethyl Acetate	22.00
Polyvinyl alcohol (No. 117)	93.00	Zinc sulphate	7.00	Ethyl Acrylate	66.00
Polyvinyl alcohol (No. 173)	145.00	<b>SOLVENTS</b>		Ethylene Dichloride	19.00
Polyvinyl alcohol (No. 208)	170.00	<b>Per Kg.</b>		Ethylene Glycol	35.00
Paraformaldehyde (Resale)	20.50	Acetic Acid Glacial (Resale)	14.50	Formic Acid (Imp.)	24.00
Phthalic anhydride (Resale)	46.00	Acetic Anhydride (Resale)	35.00	Formaldehyde (Resale)	6.00
Pentaerythritol (Resale)	44.00	Acetone (Resale)	24.00	Glycerine (CP)	48.00
Paraffin wax	22+ST	Adipic Acid	90.00	Glycerine (IW)	55.00
Rangolite (German)	96+ST	Aceto Acetanilide	50.00	Hydrogen Peroxide 50% (Resale)	39.00
Rangolite (Czech.)	72.00	Aniline Oil (HOC)	48.00	Isopropyl Alcohol	40.00
Rangolite (China)	55.00 + S.T.	Benzoate Plasticiser	62.00	Isobutyl Alcohol (Resale)	35.00
Sodium sulphate (Fine)	3.75	Butyl Acrylate	85.00	Monoethanolamine (Resale)	105.00
Sodium sulphate (Coarse)	3.50	Butyl stearate	38.00	Melamine	60.00
Sodium sulphide 50-52% (Flakes)	11.50+ST	Butanol	34.00	Methyl Ethyl Ketone	42.00
				Methyl Isobutyl Ketone	38.00
				Methyl Acrylate	68.00
				Methylene Dichloride (Resale)	20.00

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# Butyl Acetate Octyl Acetate Di Octyl Maleate

Please Contact Manufacturers:

## VIKRAM CHEMICAL INDUSTRIES

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Phones: 230006, 231192, 233554, 233562

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KISAN BRAND



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Manufacturers



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Tel. Nos: 346989/327244/320370

Telex: 011-76463 DVS IN

Gram: SULFREFINE

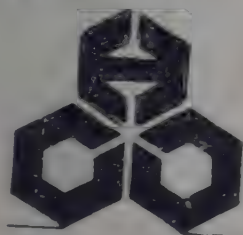
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NITROBENZENE  
FORMALDEHYDE (37% HOC)  
PHENOL (LIQUID/CRYSTAL)  
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ACRYLONITRILE  
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Please Contact:



## Hiren Chem Corporation

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Branch Office: SHINE PHARMA CHEM

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Factory: Plot No. R-375, Rabaile, M.I.D.C. Industrial Area, T.T.C.  
Thane-Belapur Road, Dist. THANE 400 701



Meta Cresol	45.00
Nitrobenzene	19.00
Nitric Acid (Conc.) (RCF)	2.50
Octanol	52.00
Ortho Cresol	30+ST
Phenol (Resale)	55.00
Propylene Glycol	52.00
Polyethylene Glycol (No.200)	75.00
Polyethylene Glycol (No.400)	80.00
Polyethylene Glycol (No.500)	52.00
Polyethylene Glycol (No.1600)	54.00
Polyethylene Glycol (No.4000)	95.00
Polyethylene Glycol (No.6000)	85.00
Para Cresol	120.00
Styrene Monomer	50.00
Sorbitol	14.00
Sulphuric Acid	2.80
Trichloroethylene	26.00
Triethanolamine (Resale)	95.00
Turpentine Oil (Germany)	8.00
Turkey Red Oil (50%)	20.00
Vinyl Acetate Monomer	55.00

SOLVENTS	Per Litre
Benzene	14.00
N-Heptane	10.50
N-Hexane	11.00
Methanol	9.25
Solvent Naphtha Heavy	10.50
Solvent Naphtha Light	8.50
Toluene	16.50
Xylene	28.00

## DYES INTERMEDIATES (PRICES ARE WITHOUT TAX AND EXCISE)

Alphanaphthylamine	65.00
Alpha Naphthol (Imp.)	160.00
Aceto Acetic Ester (Methyl)	73.00
Ammonium Molybdate	225.00
Anthraquinone	125.00
Anthranilic Acid	78.00
2-Amino 4-Nitrophenol	145.00
Blue B. Base (Local)	305.00
Beta Naphthol (Atul)	62.00
Benzidine Dihydrochloride (BDH)	76.00
Bromamine Acid	520.00
BON Acid (Incl. of excise)	145.00
Chicago Acid (Atul)	340.00
Coach Acid	52.00
C. Acid (Imp.)	200.00
Cyanuric Chloride	170.00
2,4- DNCB	28.00
Dihydrothio PTOS (Imp.)	1,600.00
Dimethyl Aniline	60.00
Diethyl Aniline	140.00
Diamino stilbene	
disulphonic acid	165.00
3,3-DCB (Imp.)	200.00
Gamma Acid (Atul)	200.00
H. Acid (Atul)	110.00
G. Salt	72.00
Isophthalic Acid	50.00
J. Acid	330.00
J. Acid Urea	440.00
K. Acid	108.00
MPDS (German)	200.00

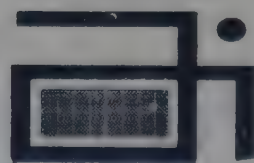
Meta Ureido Aniline	170.00
MPD (Local)	165.00
MPD (Japan)	180.00
Naphthenic Acid	46.00
N-Methyl J. Acid	500.00
N-Methyl Aniline	120.00
Naphthalene (Refined)	24.00
Ortho Anisidine (OA) (Imp.)	122.00
Ortho Dichloro Benzene (ODCB)	18.00
OT Base	130.00
Para Dichloro Benzene (PDCB)	32.00
Para Anisidine (PA local)	125.00
PNA	90.00
Para Cresidine (Imp.)	350.00
Para Amino Azo Benzene	
(India)	135.00
PNCB (HOC)	58.00
Para Amino Acetanilide	200.00
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5-Pyrazolone	135.00
Phenyl J. Acid	365.00
Para Amino Benzoic Acid	125.00
PT Base	130.00
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Resorcinol	250.00
Sodium Naphthionate	65.00
5-Sulpho-Anthranilic Acid	85.00
Sulphanilic Acid	30.00
Sulpho Tobias Acid	142.00
Trichloro Benzene (TCB)	27.00
Tobias Acid (Imp.)	132.00
Metanilic Acid	38.00
MTD (German)	130.00

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- Acetaldehyde
- Industrial Alcohol

- Monochloro Acetic Acid
- Ethyl Acetate
- Butyl Acetate

- E D T A
- N T A
- Carboxy Methyl Cellulose



### ASHOK ORGANIC INDUSTRIES LTD.

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Phone : 252236 : 252256 : 317511 Gram : 'ASHOKBROS' Telex : 11-3853 AOIL IN

#### Also Please Contact:

**Baroda :** Phones : 324519-325769

Telex : 0175-597 AOIL IN

**Ahmedabad :** Phone : 78009

**Ankleshwar :** Phone : 2461-2462

Telex : 0189-238 AOIL IN

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Telex : 021-7917 SBIL IN

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- \* SILICA GEL FABRIC BAGS
- \* PRECIOUS METAL CATALYSTS & SALTS like Pd, Pt etc.

RASHMI DHABUWALA  
(Authorised Signatory)

## R.V. CORPORATION

9, Uttam Chambers, 39, Syed Mukri Street, Katha Bazar, Bombay 400 009.

Phones: 325440/341184

Resi: 6366147

Gram: AMARJYOT, Bombay 400 009.

# SALICYLALDEHYDE/ SALICYLICALDEHYDE

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Plot 17, Bldg. 5, Flat 15, Andheri (E),  
Bombay 400 059  
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**Nasik:** Post Box No. 52  
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Phone: (0253) 62566  
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Kalbadevi, Bombay 400 002.

Phones: 292081/258697 Telex: 011-5394 ANUJ IN (SHC)

**Works:** A/8, M.I.D.C., Mahad, Distt. Raigad.

Phone: 2711/2713

# Bombay Drugs Market

(Prices as on September 24, 1990)

Product	Rs./kg.	Product	Rs./kg.	Product	Rs./kg.
Acriflavine DPC	850.00	Diphenhydramine HCL	310.00	Morpholine	140
Aluminium Hydroxide IP	43.00	Disodium Hydrogen Citrate	43.00	Niacin	220
Ampicillin Trihydrate	1750.00	Ephedrine HCL	1900.00	Niacinamide	270
Aminophylline	335.00	Erythromycin Estolate	2250.00	Nifedipine	1750
Albendazole	2100.00	Erythromycin Stearate	2050	Nitrofurazole	280
Analgin	280.00	Ethambutol IP	900.00	Oxyphenbutazone	625
Aspirin IP	85.00	Ethophylline	650.00	Papaverine HCl	2000
Atenolol	2850.00	Ferrous Fumarate	38.00	Paracetamol	155
Benzoic Acid IP	34.00	Folic Acid IP	3200.00	Pectin IP	425
Bromine	65.00	Furosemide IP	2200.00	Pepsin 1:3000	375
Bromhexine HCL	2250	Furazolidone IP	400.00	Phenbarbitone	510
Butylated Hydroxy Toluene	650.00	Guanidine Nitrate	40.00	Pheniramine Maleate	1100
Caffeine Citrate IP	360.00	Gallic Acid	285.00	Phenyl Butazone USP	550
Caffeine IP	385.00	Haloperidone	19,000.00	Piperazine Citrate	95
Calcium Gluconate IP	45.00	Hematropine Methyl Bromide	12.00	Piperazine Hexahydrate	80
Calcium Glycerophosphate	160.00	Hydrazine Hydrate	80.00	Potato Starch	65
Calcium Lactate	40.00	Ibuprofen IP	370.00	Propanolol HCL	1700
Calcium Phenethonate	635.00	Indomethazine	825.00	Pseudoephedrine HCL	2200
Cetrimide IP	210.00	I.N.H.	280.00	Pyrazinamide	1325
Chloramphenicol Powder	1650.00	Inosite IP	900.00	Ranitidine	31
Chlorbutol	95.00	Iodochloro	500.00	Rifampicin IP	3900
Chlorhexidine Gluconate 20% BP	225.00	Lactose IP	38.00	Saccharine Sodium	215
Chloroquin Phosphate	850.00	Lactic Acid	90.00	Salbutamol Sulphate	7300
Chlorpromazine HCL	1500.00	Levamisole	1500.00	Sodium Iodide	425
Choline Chloride FG	35.00	Lignocaine HCL	290.00	Sodium Methoxide	96
Choline Chloride IP	65.00	Lignocaine Base	325.00	Sorbitol Powder	115
Cloxacillin Sodium	2150.00	L. Lysine Feed	85.00	Sorbitol USP	13
Cimetidine	2050.00	L. Lysine Pharma	300.00	Sulphacetamide	300
Citric Acid IP	38.00	Magaldrate IP	40.00	Sulphamethoxazole	305
C.P. Maleate	1150.00	Magnesium Hydroxide	30.00	Tinidazole	375
Cyproheptadine Tcl	9500.00	Magnesium Trisilicate IP	11.00	Theophylline Anhydrous	390
Dexamethasone	95.00	Mannitol USP	102.00	Thiacetazone	275
Diazepam	800.00	Mebendazole	560.00	Tolbutamide	200
Dicyclomine Hcl	1500.00	Mercurochrome NF	280.00	Trimethoprim IP	980
Diethyl Carbamazine Citrate	300.00	Methyl Chloroformate	80.00	Vitamin A Palmitate	2600
Di-iodohydroxyquinoline	570.00	Metochlopromide TCL	1800.00	Vitamin B6 Hydrochloride	1400
Diloxanide Fumarate Ip	500.00	Metronidazole IP	415.00	Vitamin B2 5-Phosphate	4100

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# Bombay Dyes Market

(Prices as on September 24, 1990)

ACID COLOURS	Per Kg.
Acid Violet 4BS	*190.00
Acid Maroon V	110.00
Acid Orange II	112.55
Acid Orange IIY	93.85
Acid Red A	137.00
Acid Scarlet 3R	128.35
Acid Red 38N	*195.00
Acid Red R2R	132.00
Acid Red RS	88.00
Acid Patent Blue AS	*280.00
Acid Green V	*375.00
Acid Coomasi Blue	200.00
Acid Yellow 5GN	65.00
Acid Red PG	85.00
Acid Red GRS	78.00
Acid Black 10 BX	157.15
Acid Black BX	126.95
Acid Black Wax	135.50
Crosein Scarlet MOO	200.30
Procinil Yellow GS (ICI, UK)	265.00
Procinil Red GS (ICI, UK)	530.00
Procinil Blue RS (ICI, UK)	315.00
Procinil Scarlet G (ICI, UK)	600.00
Procinil Orange G (ICI, UK)	250.00
Procinil Rubine (ICI, UK)	550.00

\* To get resale price add 6% tax.

DIRECT COLOURS	Per Kg.
Yellow 3GX	114.00
Gun Yellow RCH	175.85
Fast Yellow GCH	171.50
Yellow CFG Hly. Conc.	721.00
Fast Yellow G3	126.96
Fast Yellow CHRS	116.85
Viscose Orange A	210.35
Fast Orange GR	171.50
Red	122.65
Dark Tan	98.15
Red IIR	98.15
Red 4B	217.55
Bordeaux BW	170.10
Fast Scarlet 4BS	223.50
Red 12B	220.45
Bordeaux Hly. Conc.	249.20
Cotton Red N	117.05
Brill. Fast Helio B	362.85

Brill. Fast Helio 2R	385.83
Brill. Fast Helio 2RS	177.30
Brill. Fast Helio BS	116.10
Brill. Violet Extra	181.45
Blue 2B	102.50
Blue G	220.45
Sky Blue FB	242.00
Copper Blue GR	190.25
Fast Greenish Blue GL	114.60
Developed Black BT	149.95
Blue NB-2B	348.45
Blue NB-2BG	214.70
Developed Black NB-GHB	214.70
Green B	142.75
Green NB-B	218.90
Green 2B-N	218.90
Brown MR	197.40
Brown CN	137.00
Golden Brown G	175.85
Catechin G	155.70
Omega Tan	161.45
Catechin GS	102.80
Black E Hly Conc.	180.15
Black E Extra Hly. Conc.	180.15
Black NB-ER Hly. Conc.	290.50

DISPERSOL COLOURS	Per Kg.
Red B 3B Conc.	611.50
Red B 2B Conc.	797.90
Red CB Powder	1048.25
Red D2B Powder	580.65
Violet C 4R	1202.70
Blue BG Powder	580.65
Blue BN Powder	128.25
Blue D 2R Powder	588.25
Navy BT Conc.	531.95
Blue B 2G Conc.	577.95
Blue BT Conc.	319.50
Blue BR	482.40
Yellow 7GL	813.20
Yellow 5RX	269.90
Yellow 3G	473.20
Yellow	140.00
Yellow AL	167.20
Yellow Brown REL	311.70
Yellow FFL	571.40
Gold Yellow GG	320.80
Pink REL	593.00
Red BEL	615.60

Red 2B	422.40
Red FB	425.80
Red Violet FBL	622.00
Orange 3R	254.20
Violet 3R	370.50
Violet RL	355.70
Violet 6R	638.20
Scarlet RR	283.50
Rubine 3B	289.10
Rubine CB	449.50
Blue GL	419.00
Blue BGF	805.80
Navy Blue RE	359.90
Brown 3REL	272.80
Black GEL	420.10
Dark Brown 3B	411.10

BASE COLOURS	Per Kg.
Fast Yellow GC	77.75
Fast Orange GC	128.40
Fast Scarlet R	198.05
Fast Scarlet RC	128.40
Fast Scarlet RCR	105.60
Fast Scarlet G	115.75
Fast Scarlet GN	92.95
Fast Scarlet GG	77.75
Fast Scarlet GGS	73.95
Fast Red B	233.50
Fast Red RC	115.75
Fast Red R Flakes	158.80
Fast Red TR	181.60
Fast Red TR Oil	223.35
Fast Red RL	251.20
Fast Red KB Oil	251.20
Fast Bordeaux GP	236.00
Fast Garnet GBC	103.05
Fast Violet B	548.80
Fast Blue BB	566.50

NAPHTHOL COLOURS	Per Kg.
ASG	301.85
AS	205.65
ASSW	379.10
ASBS	253.75
ASBO	266.40
ASD	209.45
ASOL	243.60

# Delhi Market

**DELHI: SEPTEMBER 21: NNS** Sodium nitrite spurted sharply by Rs. 150/225 at Rs. 1200/1500 per 50 kg. in the Delhi chemicals market during last week, on account of heavy buying support by the stockists, coupled with dwindling stock fall in fresh supply, reports NNS. Sodium sulphate DCM Red marka went up from Rs. 3900 to Rs. 4100 and Black marka flared up from Rs. 3700 to Rs. 3900 per tonne due to shortage of floating stock. Sodium sulphate Gwalior Rayon quoted higher by Rs. 50 at Rs. 3650 in the wake of good demand from consumers. Following fall in import from Germany and rise in demand by consumers, rangolite Germany jumped up Rs. 5 at Rs. 95 per kg. Citric acid Chinese advanced by Rs. 50 at Rs. 1950 per 50 kg. followed by higher advices from Bombay, whereas citric acid Bombay Dyeing remained quiet at Rs. 2350. Ammonium Chloride hardened by Rs. 20 at Rs. 140/180 per 50 kg. due to poor supply. Naphthalene balls rose from Rs. 1350 to Rs. 1370 in the wake of keen buying support by the stockists. As a result

of increased mutual speculation between stockists and distributors, chatkolite and titanium dioxide TTK quoted higher by 50 paise/Re. one at Rs. 56 and Rs. 64 per kg. respectively. K-brand titanium dioxide moved up from Rs. 58 to Rs. 59. RC-822 and RCR-2 remained firm at Rs. 88 and Rs. 92 per kg. respectively. In the absence of import from France alongwith higher prices quoted by the stockists, tartaric acid France registered a sharp rise of Rs. 14 at Rs. 314 per kg., whereas tartaric acid Swastic brand ruled quiet at Rs. 210 per kg. On account of poor supply and good demand acetic acid hardened from Rs. 24 to Rs. 25. Following fall in demand from Pakistan and Afghanistan, coupled with improved arrival, menthol flake and bold slipped by Rs. 3/5 at Rs. 277 and Rs. 320/kg. Menthol oil quoted cheaper by Rs. 2 at Rs. 190. Borax crystal and paraffin slumped by Rs. 25 and Rs. 50 at Rs. 850 and Rs. 1200 per 50 kg. due to the lack of fresh buying. Borax granular receded by Rs. 10. Tri sodium phosphate being was offered Rs. 600 against Rs. 625.

## (DELHI MARKET RATES AS ON SEPTEMBER 21, 1990)

Ammonia Bicarb (Per 25 Kg.)	180.00
Mercury (Per flask)	11,100.00
Soda ash (Per bag)	360/373.00
Ammonium Chloride (50 Kg.)	140/180.00
Caustic soda flakes (50 Kg.)	525.00
Citric acid (Per 50 Kg.)	1,950/2,350.00
Stable Bleaching Powder	
Shriram (Per 25 Kg.)	101.00
Stable Bleaching Powder KCl	
(Per 25 Kg.)	90.00
Stable Bleaching Powder	
Maruti (Per 25 Kg.)	91.00
Stable Bleaching Powder	
Modi (Per 25 Kg.)	92.00
Sodium Bicarbonate (50 Kg.)	315/325.00
Sodium Hydrosulphite (Per Kg.)	43/46.00
Rangolite (Per Kg.)	95.00

Tartaric acid France (Per Kg.)	314.00
Sufolite (Per Kg.)	58.50
Chatkolite (Per Kg.)	56.00
DMO (per Kg.)	88.00
Boric acid Technical (Per 50 Kg.)	1,550.00
Paraffin Wax (Per 50 Kg.)	1,200.00
Slack wax (Per metric tonne)	13,500.00
Tartaric Acid (Swastik Per Kg.)	210.00
Borax Granular (Per 50 Kg.)	840.00
Borax Crystal (Per 50 Kg.)	850.00
Sodium Nitrite (Per 50 Kg.)	1,200/1,500.00
Sodium Nitrate (Per 50 Kg.)	500.00
Camphor Thal (Per Kg.)	110.00
Camphor Powder (Per Kg.)	96.00
Menthol Bold (Per Kg.)	320.00
Menthol Medium (Per Kg.)	300.00
Menthol Flake (Per Kg.)	277.00

Mentha Oil (Per Kg.)	190.00
Glycerine (Per Kg.)	53/58.00
Sodium Silicate (Per quintal)	300/400.00
Hexamine (Per Kg.)	34.00
Acetic Acid Glacial (Per Kg.)	14.75
Copper Sulphate	
(Per quintal)	2,400/2,600.00
Formic Acid (Per Kg.)	25.00
Formaldehyde (Per Kg.)	8.50
Hydrogen Peroxide (Per Kg.)	38.00
Calcium Carbonate	
(Per Tonne)	2,800/5,800.00
Acid Slurry Soft (Per Kg.)	27.00
Acid Slurry Hard (Per Kg.)	32.00
Phosphoric Acid (Per 50 Kg.)	1,235.00
Potassium Nitrate	
(Per quintal)	1,000/1,250.00
Potassium Permanganate	
(Per 50 Kg.)	2,600/3,000.00
Sodium Bichromate	
(Per 50 Kg.)	1,575/1,600.00
Trisodium Phosphate (50 Kg.)	600.00
Titanium Dioxide Anatase T.T.P.	
(Per Kg.)	64.00
Titanium Dioxide RC-822 (Per Kg.)	92.00
Titanium Dioxide Anatase K-Brand	
(Per Kg.)	59.00
Titanium Dioxide RCR-2 (Per Kg.)	88.00
Zinc Oxide (Per Kg.)	46.00/50.00
Phenol Carbolic Acid (Per Kg.)	39.00
Carbon Tetrachloride (Per Kg.)	24.75
Chloroform (Per Kg.)	28.00
Sodium Sulphate	
(Per metric tonne)	3,650/4,100.00
Naphthalene Balls (Per 50 Kg.)	1,370.00
Match Wax	20,000.00
Residue Wax	4,600.00

## DYES & COLOURS (Per Kg.)

Naphthol AS	175/211.50
Naphthol ASG	180/249.70
Naphthol ASBS	210/260.75
Naphthol ASTR	300/378.92
Naphthol ASOL	210/250.90
Naphthol ASBO	195/274.30

## DIRECT DYES (Per Kg.)

Black E. Conc.	120/185.30
Diazo Black B.T.	105/154.50
Green B	90/147.55
Blue 2-B	60/107.00
Blue 2-B 225% (JNR)	125.00
Sky Blue FB	160/248.20
Basic Auramine	55/110.00
Basic Rhodamine	300/425.00
Basic Methylene Blue	100/180.00
Basic Violet	165/210.00
Basic Malachite Green	175.00
Acid Orange	75/111.20
Congo Red H/C	75/120.95

## Madras Market

The prices of chemicals that went up over last week has more or less remained stable. Though Andhra sugars caustic soda flakes was quoted same as that of Mettur Chemicals (now Chemplast) there is not much stock in the market and only Chemplast & DCW's materials were traded. Due to continued closure of NOCIL their solvents were in

good demand. There was good demand for products like phthalic anhydride, phenol etc. and adequate quantities could not be procured even at the higher prices. Though it is reported that National Peroxide's unit has commenced production of hydrogen peroxide the market is still firm at Rs. 40/- per kg since fresh stocks are yet to arrive.

### (MADRAS MARKET RATES AS ON SEPTEMBER 22, 1990)

Acetic Acid Glacial (per kg)	16.00	Hydrosulphite of Soda (BASF) (per kg)	48.00
Aluminium Sulphate Iron free (per MT)	4,000.00	Hexamine (per kg)	31.50
Ammonium Bicarbonate (per 25 kgs)	160.00	Hyflosupercell (per kg)	30.00
Ammonium Chloride (per MT)	2,450.00	Hydrogen Peroxide (per kg)	40.00
Acid Slurry (per kg)	31.00	Litharge (per kg)	38.00
Barium Carbonate (per kg)	10.50	Lead Acetate (per kg)	16.50
Barium Chloride (per kg)	9.50	Magnesium Carbonate (per kg)	18.00
Boric Acid Technical (per kg)	26.00	Magnesium Chloride (per kg)	4.00
Bleaching Powder (per 50 kgs)	220.00	Maleic Anhydride (per kg)	44.00
Borax (per 50 kgs)	785.00	Menthol Crystals (per kg)	400.00
Caustic Soda Flakes -- Mettur Chemicals (per MT)	11,300.00	Oxalic Acid (per kg)	18.00
Caustic Soda Flakes -- Andhra Sugars (per MT)	11,300.00	Paraffin Wax (per kg)	18.00
Calcium Chloride 70% Solid (per MT)	3,800.00	Potassium Bichromate (per kg)	36.00
Calcium Chloride Anhydrous (per MT)	6,000.00	Phosphoric Acid (per kg)	28.00
Calcium Carbonate (Activated) (per MT)	6,600.00	Polyvinyl Alcohol Powder (per kg)	140.00
Calcium Carbonate (Precipitated) (per MT)	5,750.00	Pentaerythritol (per kg)	52.00
Citric Acid (per kg)	48.00	Phthalic Anhydride (per kg)	40.00
Copper Sulphate (per kg)	24.00	Soda Ash (TAC) (per 75 kgs)	415.00
Cresylic Acid 98-99% (per kg)	135.00	Soda Ash (TATA) (per 75 kgs)	415.00
Pure Para Cresol 96% (per kg)	90.00	Sodium Bicarbonate (TATA) (per 50 kgs)	390.00
Meta Para Cresol 42% (per kg)	52.00	Sodium Silicate (per MT)	3,850.00
Formic Acid (per kg)	26.00	Sodium Bichromate (per kg)	28.00
Formaldehyde (per kg)	8.00	Sodium Nitrate (per kg)	8.00
Glue Flakes (per kg)	15.00	Sodium Nitrite (per kg)	26.00
Glycerine I.W. (per kg)	50.00	Sodium Sulphide Flakes (per kg)	20.00
Hydrosulphite of Soda (TCPL) (per kg)	42.00	Sodium Bisulphite (per kg)	8.00
Hydrosulphite of Soda (IDI) (per kg)	45.00	Sodium Alginate (per kg)	350.00
		Sodium Acetate (per kg)	7.50
		Sodium Sulphate (Anhydrous) (per kg)	4.00
		Titanium Dioxide (Anatase) (per kg)	62.00
		Titanium Dioxide (Rutile) (per kg)	85.00
		Trisodium Phosphate (per kg)	11.00
		Urea (Technical) (per kg)	3.00
		Zinc Oxide (per kg)	52.00

### CALCUTTA MARKET (Prices as on Sep. 23, 1990)

Acetic acid (per 50 kg)	750.00
Basic chrome sulphate (per 50 kg)	800.00
Benzene (litre)	11.50
Bleaching powder (bag)	235.00
Borax granular (per 50 kg)	800.00
Boric acid (per 50 kg)	1,625.00
Camphor (per kg)	102.00
Caustic soda lye (per ton)	10,020.00
Caustic soda flakes (per 50 kg)	560.00
Glycerine (per kg)	53.50
Menthol bold (per kg)	570.00
Menthol medium (per kg)	380.00
Menthol small (per kg)	300.00
Phosphoric acid (per 50 kg)	1,400.00
Phenol (per kg)	38.50
Soda ash (75 kg)	395.00
Sodium bichromate (per 50 kg)	1,500.00
Sodium bicarbonate (per 50 kg)	340.00
Sodium nitrate (per 50 kg)	450.00
Sodium sulphate anhydrous (per 50 kg)	320.00
Sulphuric acid (per ton)	2,200.00
Trisodium phosphate (per 50 kg)	610.00
Toluene (litre)	16.50

Zinc Chloride Powder (per kg)	14.00
Zinc Sulphate (per kg)	8.00

### SOLVENTS

Acetone -- HOCL (per kg)	22.00
Butanol (per kg)	36.00
Butyl Acetate (per kg)	42.00
Benzene (per lit)	14.00
Cellosolve (per kg)	65.00
Carbon Tetra Chloride (per kg)	23.00
Chloroform (per kg)	28.00
Diacetone Alcohol (per kg)	30.00
Diethylene Glycol (per kg)	38.00
Dichloroethane (per kg)	18.00
Di-octyl Phthalate (per kg)	48.00
Di-N-butyl Phthalate (per kg)	48.00
Ethyl Acetate (per kg)	22.00
Isopropyl Alcohol (per kg)	34.00
Methanol (per kg)	12.00
Methylene Chloride (per kg)	23.00
Methyl Ethyl Ketone (per kg)	38.00
Methyl Isobutyl Ketone (per kg)	41.50
Phenol (per kg)	50.00
Sorbitol (per kg)	15.00
Triethanolamine (per kg)	95.00
Trichloroethylene (per kg)	26.50
1-1-1 Trichloroethane (per kg)	29.00
Turpentine (per lit)	16.50
Toluene (per lit)	16.00
Xylene (per lit)	25.00

# Shipping News

## VESSELS DUE IN BOMBAY FOR EXPORT LOADING

	Steamer's Name & Flag (2)	Agents (3)	Will load for (4)	Approx. sailing dt. (5)
0	Vishva Parijat (Ind)	S.C.I.	New York; Baltimore; Savannah; Norfolk; Charleston; Houston; Jacksonville; New Orleans; Boston; P. Everglades. (Carting at B. Pier Extn.).	13/10
0	Ever Bridge (Voy-039)	Greenways	New York; Newark; Baltimore; Charleston; New Orleans; Houston; Boston; Providence (RI); Philadelphia; Norfolk; Savannah; Jacksonville; Wilmington; Miami; Montreal; Toronto; Bermuda; Los Angeles; Longbeach; San Francisco; Oakland; San Diego; Stockton; Richmond; Almeida; Redwood City; Sacramento; Seattle; Portland; Vancouver (B.C.); Tacoma; Longview; Chicago; Dallas; Various inland destinations and Caribbean Ports. (Carting at G/H Cotton Depot).	12/10
/9	Anika Oltmann	Samrat/ Hindustan	Boston; New York; Baltimore; Norfolk; Charleston; P. Mouth; P. Lauderdale; Miami; New Orleans; Savannah; Jacksonville; P. Everglades; Philadelphia; Halifax; Montreal; Toronto & S. American Ports. (Carting at M.O.D. No. 1 for both).	3/10
10	CMB Merzario (Nhava Sheva)	C.M.B.	Norfolk; New York; Baltimore; Philadelphia; Charleston; Savannah; Houston; Miami; New Orleans; Via Antwerp; Montreal; Toronto; Halifax. (Carting at Kalamboli).	8/10
10	Maersk Clementine (Sing)(V-9019)	Maersk Agency	New York; Philadelphia; Baltimore; Norfolk; Charleston; Savannah; Jacksonville; Miami; New Orleans; Houston; Toronto; Montreal; Chicago; Atlanta; Denver; Dallas; Wilmington; Milwaukee; Detroit; Minneapolis; Memphis; Nashville; Cleveland; Phoenix; Boston; Los Angeles; Vancouver; Seattle; San Francisco; Portland; Longbeach; Mexican & S. American Ports. (Carting at 19-ID).	6/10
/10	Mulbera	Killick	S. American Ports.	7/10
/10	CMB Merzario (Nhava Sheva)	C.M.B.	Lagos; Abidjan; Lome; Douala; Matadi; Port Gentil; Pointe Noire; Nouakchott; Cotonou; Dakar; Luanda; Monrovia; Tema via Antwerp. (Carting at Kalamboli).	8/10
/10	Maersk Clementine	Maersk Agency	Lagos/Apapa; Dakar; Freetown; Monrovia; Lome; Cotonou; Doula; Tema. (Carting at 19-ID).	6/10
/10	Vishva Parijat (Ind)	S.C.I.	Felixstowe; Hamburg; Rotterdam; Antwerp; Bremen; Liverpool; Manchester; Avonmouth; London; Belfast; Aarhus; Oslo; Helsinki; Copenhagen; Gothenburg & all Inland destinations. (Carting at B. Pier Extn.).	13/10
5/10	Ever Bridge (V-039) (Pan)	Greenways	Hamburg; Felixstowe; Rotterdam; Antwerp; Le Havre; London; Liverpool; Leixoes; Lisbon; Manchester; Avonmouth; Wembley; Birmingham; Leeds; Leicester; Ambsterdam; Bremen; Copenhagen; Aarhus; Gothenburg; Oslo; Stockholm; Helsinki; Belfast & all destina- tions in U.K.; Germany; Switzerland & Austria. (Carting at G/H Cotton Depot).	12/10
7/10	CMB Merzario (Nhava Sheva)	C.M.B./ Merzario	Port Sudan; Jeddah; La Spezia; Valencia; Genoa; Barcelona; Marseilles; Tunis; Casablanca; Tangier; Alexandria; Piraeus; Mersin; Limassol; Felixstowe; London; Liverpool; Manchester; Birmingham; Avonmouth; Dublin and all inland destinations in U.K.; Antwerp; Rotterdam; Hamburg; Bremen; Leixoes; Lisbon; Copenhagen; Oslo; Gothenburg; Stockholm; Malmao; Aarhus; Helsinki. (Carting at Kalamboli for both).	8/10
1/10	Maersk Clementine	Maersk Agency	Leghorn; Marseilles; Naples; Barcelona; Bilbao; Bordeaux; Alicante; Genoa; Valencia; Bremen; Jeddah; Antwerp; Rotterdam; Bremerhaven; Hamburg; U.K. & Scandinavian ports. (Carting at 19-ID).	6/10
1/10	Ville De Colombo (Ger) (Voy-2221)	C.M.A.	Alexandria; Marseilles; Istanbul; Lisbon; Barcelona; Le Havre; Hamburg; Felixstowe; Thames Port (London); Rotterdam; Antwerp; Limassol; Lattakia; Tunis; Copenhagen; Aarhus; Gothenburg; Stockholm; Helsinki; Belfast. (Carting at E-Grain Depot).	4/10
28/9	Anika Oltmann (Ger)	Samrat/ Hindustan	Felixstowe; Hamburg; Rotterdam; Also London; Liverpool; Leixoes; Lisbon; Manchester; Avonmouth; Wembley; Birmingham; Leicester; London; Bremen; Amsterdam; Antwerp; Copenhagen; Leeds;	3/10

(1)	(2)	(3)	(4)	(5)
			Aarhus; Gothenburg; Oslo; Helsinki; Stockholm; Belfast & all destinations in U.K.; Benelux; Germany; France; Switzerland and Austria; Barcelona; Marseilles; La Spezia; Livorno; (Leghorn); Genoa; and other Italian Ports and FCL only Beirut; Alexandria; Valletta; Limassol; Larnaca; Lattakia; Mersin; Izmir. (Carting at M.O.D. No. 1 for Samrat & Hindustan).	
		Killick/	Felixstowe; Rotterdam; Hamburg; Antwerp; Le Havre; Lisbon; Leixoes; London; Liverpool; Manchester; Bristol; Avonmouth; Leeds; Glasgow; Tilbury; Birmingham; Dublin; Belfast; Bremen; Bremerhaven; Aarhus; Copenhagen; Gothenburg; Helsinborg; Oslo; Helsinki; Alexandira; Lattakia; Mersin; Malta; Limassol; Piraeus. (Carting at E-Shed Grain Depot).	
		L. Triest	U.K. & Inland destinations; Hamburg; Rotterdam & inland destinations in Cont. (Carting at 171/173 Cotton Depot).	
6/10	Ever Briega (V-039) (Pan)	Greenways	Singapore; Penang; Port Kelang; Bangkok; Djarkarta; Surabaya; Manila; Cebu; Kaohsiung; Keelung; Osaka; Yokohama; Kobe; Shimizu; Moji; Nagoya; Busan; Hongkong. (Carting at G/H Cotton Depot).	11/10
5/10	Mulbera	I.M.E./Killick/ P&O	Singapore.	7/10
1/10	Maersk Clementine (Sing)(V-9019)	Maersk Agency	Penang; Singapore; Hongkong; Keelung; Kaohsiung; Busan; Main Japan Ports; Manila; Jakarta; Surabaya; Bangkok; P. Kelang; Chinese Ports. (Carting at 19-ID).	6/10
5/10	Mulbera	P&O/ Killick/	Melbourne; Sydney; Brisbane; Adelaide; Fremantle; P. Hobart; Devon P.; Launceston; Brunei; New Plymouth; Auckland; Wellington; Lyttelton; P. Chalmers; Christchurch; Dunedin; Napier. Also Western Samoa; Papua New Guinea; Solomon Island; American Samoa; Tonga; New Caledonia; P. Villa.	7/10
		I.M.E.	Sydney; Melbourne; Adelaide; Fremantle; Brisbane; Auckland; Wellington; Lyttelton.	
1/10	Ville De Colombo	C.M.A.	Dubai; Mina Qaboos; Abu Dhabi; Bahrain; Doha; Dammam; Riyadh. (Carting at E-Shed Grain Depot).	4/10
1/10	Maersk Clementine	Maersk Agency	Dubai; Dammam; Muscat; Bahrain; Riyadh; Doha. (Carting at 19-ID).	6/10
7/10	CMB Merzario (Nhava Sheva)	CMB/ Merzario	Dubai; Abu Dhabi; Bahrain; Dammam; Doha. (Carting at Kalamboli for Both).	8/10
3/10	Gulf Spirit	Jades Ship	Dubai; Sharjah.	12/10
7/10	CMB Merzario (Nhava Sheva)	C.M.B.	Dar Es Salaam; Mombasa (Direct); Nacala; Tonga; Kampala; Blantyre; Lusaka; Ndola; Matwara; Lilongwe & all inland destinations in East Africa. (Carting at Kalamboli).	8/10
27/9	Any (Pan)	SDS Corpn.	P. Louis; Tamatave; Re Union.	7/10

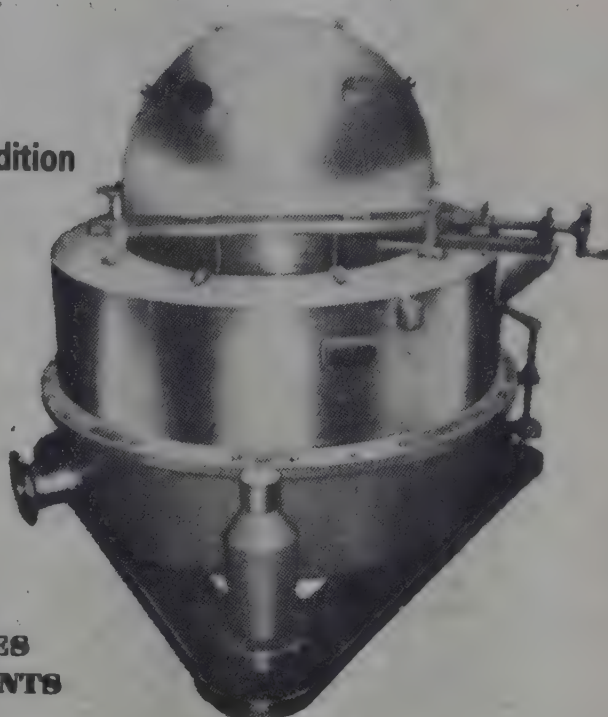
## VESSELS DUE FOR IMPORT DISCHARGE

Due Date	Steamer's Name	Agents	From
6/10	Future Hope	Prudential	Cont.
3/10	Gulf Spirit	Jades Ship	Ajman
5/10	Mulbera	P&O/Killick/I.M.E.	Australia/New Zealand & Gulf
8/10	Vishva Pankaj	S.C.I.	U.K. Cont.
8/10	Vishva Parijat	S.C.I.	U.K. Cont./U.S.

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# Materials Exported/Imported

## MATERIALS EXPORTED BOMBAY (From 25.2.90 to 28.2.90)

ACIDO METANILICO META-NILIC ACID: To Barcelona: Jeevan Products, 18,000 Kgs., Rs. 9,85,020.

ALUMINIUM CHLORIDE: To Felixstowe: Aroni Chemicals, 39,000 Kgs., Rs. 5,63,549; Mangalam Rasayan Pvt. Ltd., 19,800 Kgs., Rs. 2,86,737.

ALUMINIUM STERATE: To Nuku Alofa: Asian Paints (I) Ltd., 510 Kgs., Rs. 21,420.

D 2 AMINOBUTANOL: To Rotterdam: Lupin International, 2,000 Kgs., Rs. 12,77,000.

CHLORPHENIRAMINE MALEATE: To Barcelona: Mehta Pharms. Inds., 50 Kgs., Rs. 36,000.

4:4 DIAMINO STILBENE 2: 2 DISULPHONIC ACID: To Barcelona: Hickson & Dadajee Ltd., 13,080, Kgs., Rs. 15,54,501.

2:5 DICHLORO ANILINE: To New York: 2,100 Kgs., Rs. 11,7,000.

DI ETHYL OXALATE: To Bangkok: Excel Inds., Ltd., 15,000 Kgs., Rs. 4,30,693.

4:4 DINITRO STILBENE 2-2 DISULPHONIC ACID: To Barcelona: Jeevan Oxychem Products, 2,200 Kgs., Rs. 1,23,104.

FURFURALDEHYDE: To Antwerp: Oswal Agro Furane Ltd., 3,00,118 Kgs., Rs. 49,54,241.

FUNGICIDES: To Antwerp: BASF India Ltd., 12,500 Kgs., Rs. 21,25,657.

GAMMA ACID: To Leeds: Sandoz (I) Ltd., 3,227 Kgs., Rs. 4,11,319; To Le Havre: Sandoz (I) Ltd., 2,150 Kgs., Rs. 2,84,832.

GELATINE: To Felixstowe: C.T. Gelatine Products Ltd., 16,000 Kgs., Rs. 9,22,657.

GUJOXIME: To Melbourne: Gujarat State Fertilizers Co., 4,940 Mts., Rs. 1,50,500.

H. ACID: To Hamburg: Dadamol Intermediates Dyes, 10,250 Kgs., Rs. 9,53,827.

HYDROGEN PEROXIDE: To Bangkok: National Peroxide Ltd., 102,96 Mts., Rs. 8,70,000.

MEBENDAZOLE: To Antwerp: Flamingo Impex Pvt. Ltd., 475 Kgs., Rs. 1,51,489.

METHYL PARATHION TECH 80%: To Piraeus: Bayer India Ltd., 18,000 Kgs., Rs. 12,09,872.

OXALIC ACID: To Barcelona: Excel India., 18,000 Kgs., Rs. 2,63,404; To Leghorn: Chika Ltd., 18,000 Kgs., Rs. 2,64,170.

PARATOLUENE SULFONAMIDE: To Antwerp: Garuda Chemicals,

5,000 Kgs., Rs. 1,98,710.

PENTAERYTHRITOL: To Felixstowe: Kanoria Chemicals & Industries Ltd., 20,000 Kgs., Rs. 3,16,806.

SODIUM FORMALDEHYDE SULPHOXYLATE: To La Special: Transpek Industry Ltd., 25,000 Kgs., Rs. 9,32,766.

SODIUM FORMALDEHYDE SULPHOXYLATE: To Istanbul: Transpek Indus. Ltd., 18,000 Kgs., Rs. 5,48,085.

SODIUM SULPHATE: To Bangkok: Grasim Industries Ltd., 700 Mts., Rs. 13,89,943.

SODIUM META NITROBENZENE SULFONATE: To Barcelona: Sadhana Nitro Chem Ltd., 5,000 Kgs., Rs. 1,29,268; To Rotterdam: Sadhana Nitro Chem Ltd., 14,000 Kgs., Rs. 3,75,784.

SODIUM NAPHTHIONATE: To Genoa: Liberty Exports Limited,

READILY AVAILABLE

# ACETONE

CONTACT:

## AROMA CHEMICALS

Krishna Bhavan, 1st Floor,  
Bhakta Kavi Shivji Devshi Marg,  
Deonar, Bombay 400 088

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Telex: 011-75469

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## DYE MATERIALS EXPORTED BOMBAY (From 9.3.90)

CHLORANIL: To New York: Indo Dye Chem Inds., 3,000 Kgs., Rs. 2,27,489.

DYE INTERMEDIATE: To Bangkok: IDI Ltd., 2,000 Kgs., Rs. 7,63,000; To Busan: Metro Chem Inds., 16,000 Kgs., Rs. 11,78,672; To Keelung: Alfa Beta Chemicals Ltd., 17,000 Kgs., Rs. 4,80,000; To Kobe: Espee Chemicals, 1,000 Kgs., Rs. 96,340; To New York: Alchemie Dye Chem Ltd., 1,000 Kgs., Rs. 1,30,000; Atul Products Ltd., 22,500 Kgs., Rs. 19,08,719; H & H Intl., 78,911 Kgs., Rs. 3,44,975; Metro Chem Inds., 25,362 Kgs., Rs. 26,18,851; IDI Limited, 45 Mts., Rs. 3,30,000.

DYESTUFFS: To Bangkok: IDI Ltd., 3,357 Kgs., Rs. 9,34,000; K. Patel

Chemo Pharma P. Ltd., 3,000 Kgs., Rs. 1,35,000; To Boston: IDI Ltd., 1,000 Kgs., Rs. 1,11,000; To Buenos Aires: Mangalya Trad. Invs., 700 Kgs., Rs. 1,39,300; To Busan: Mangalya Trad & Invest., 1,500 Kgs., Rs. 1,63,000; To Hong Kong: Bhoir Import Export P. Ltd., 3,000 Kgs., Rs. 3,19,149; To Jakarta: Ravi Chem Dye, 10,000 Kgs., Rs. 9,83,920; Satyawati Chemicals, 4,000 Kgs., Rs. 2,92,000; To New York: Atic Inds., Ltd., 9,104 Kgs., Rs. 47,48,936; Gujarat State Export Corpn., Ltd., 2,000 Kgs., Rs. 2,77,000; Jindal Dye Intermediates P. Ltd., 13,269 Kgs., Rs. 14,52,255; IDI Ltd., 5,700 Kgs., Rs. 20,84,000; To Port Kelang: Dyestuff & Chem Co., 3,000 Kgs., Rs. 2,04,000; To Singapore: Bhoir Import Export P. Ltd., 1,000 Kgs.,

FAST RED B BASE: To New York: Nandosol Inds., 5,000 Kgs., Rs. 6,46,809.

METHYL VIOLET BASE: To New York: Sahayadri Dyestuffs Chem., 975

Kgs., Rs. 2,15,000.

PHTHALOCYANINE BLUE: To New York: Jay Chemical Inds., 19,000 Kgs., Rs. 60,000.

REACTIVE BLACK: To Charleston: Jansons Intl., 5,000 Kgs., Rs. 5,14,042.

REACTIVE BLUE 21: To Hong Kong: Jay Chemical Inds., 3,000 Kgs., Rs. 3,02,000.

REACTIVE BLUE 71: To Charleston: Colori Intl., 2,000 Kgs., Rs. 3,91,490; Jansons Intl., 1,000 Kgs., Rs. 1,64,255.

REACTIVE GOL. YELLOW HBR: To New York: Jansons Intl., 3,500 Kgs., Rs. 5,75,318.

REACTIVE NAVY BLUE HE 4 R: To Bangkok: Nivin Overseas Corp., 1,000 Kgs., Rs. 1,23,500.

REACTIVE RED 6BX: To Busan: Space Intl., 200 Kgs., Rs. 27,914.

REACTIVE RED 180: To New York: Jansons Intl., 2,500 Kgs., Rs. 5,35,043.

REACTOFIX RED MC4BL: To New York: Jaysynth Dyechem Ltd., 8,790 Kgs., Rs. 16,57,473.

REACTIVE YELLOW 15: To Charleston: Janson Intl., 2,000 Kgs., Rs. 3,57,447.

REACTIVE YELLOW 17: To Charleston: Janson Intl., 2,000 Kgs., Rs. 5,64,255; To New York: Colori Intl., 2,000 Kgs., Rs. 5,67,654.

REACTIVE YELLOW GR: To Busan: Associated Intermediates & Chem, 1,000 Kgs., Rs. 1,76,000.

REACTOFIX NAVY BLUE M3R: To Sydney: Jaysynth Dyechem Ltd., 1,500 Kgs., Rs. 2,21,277.

REACTOFIX SUPRA BLACK HBL: To Sydney: R.P. Trading Co., 3,000 Kgs., Rs. 3,53,191.

REACTIVE YELLOW HE 64: To New York: Jay Chem Inds., 1,500 Kgs.,

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Rs. 1,57,446; To Busan: Associated Intermediates, 5,800 Kgs., Rs. 8,46,000; Miviv Overseas Corp., 2,000 Kgs., Rs. 2,34,043; To Charleston: Jay Chemical Inds., 5,000 Kgs., Rs. 8,40,000; Priya Electronics & Chem., 500 Kgs., Rs. 87,713; To Hong Kong: Jay Chemical Colour Inds., 3,000 Kgs., Rs. 4,83,405; Jaysynth Dychem Ltd., 1,000 Kgs., Rs. 3,09,787; To Jakarta: Dintex Dychem Inds., 3,500 Kgs., Rs. 2,34,605; To Keelung: Arti Organics P. Ltd., 2,411 Kgs., Rs. 3,86,000; To Kobe: Nivin Overseas Corp., 300 Kgs., Rs. 39,149; To Miami: JBF Inds., Ltd., 1,000 Kgs., Rs. 1,37,872.

**SYNTHETIC ORGANIC DYES:** To New York: IDI Ltd., 1,100 Kgs., Rs. 3,58,000.

**TURQUOISE BLUE:** To Busan: Associated Intermediates & Chemicals, 500 Kgs., Rs. 58,000.

**TURQUOISE BLUE G:** To Busan: Dintex Dychem Inds., 1,000 Kgs., Rs. 94,315.

**TURQUOISE BLUE G:** To Chicago: Jay Chemical Inds., 5,000 Kgs., Rs. 5,00,000.

**VAT ORANGE:** To New York: Chemicals & Dyestuff Inds., 1,020 Kgs., Rs. 4,61,805.

#### **DYES MATERIALS EXPORTED BOMBAY (5.3.90)**

**ACID RED 52:** To Keelung: Little & Co., 300 Kgs., Rs. 1,21,553.

**ACID RHODAMINE B SUPRA:** To Keelung: Priya Elect & Chem., 500 Kgs., Rs. 1,97,500.

**BRILLIANT BLUE IBN 140:** To Singapore: Sanjay Sales Corp., 1,500 Kgs., Rs. 4,03,410.

**DIANISIDINE BASE:** To Priok: Amritlal Chemaux Ltd., 2,000 Kgs., Rs. 4,03,471.

**DIRECT BLACK 38:** To Kobe:

Priya Elect & Chemicals, 2,510 Kgs., Rs. 2,32,751.

**DYE INTERMEDIATES:** To Genoa: Priya Chemicals & Pharma Ltd., 36,000 Kgs., Rs. 4,85,330.

**DYESTUFFS:** To Hamburg: Arti Organics P. Ltd., 6,702 Kgs., Rs. 11,30,000; To Busan: Amritlal Chemaux Ltd., 2,000 Kgs., Rs. 2,07,060; To Jakarta: Indochem Ltd., 2,250 Kgs., Rs. 2,46,798; Trans Dyestuff Inds., 4,000 Kgs., Rs. 4,17,276; To Manila: Jaysynth Dye Chem Ltd., 2,875 Kgs., Rs. 4,85,106; To Rotterdam: Brinda Export Agencies, 2,000 Kgs., Rs. 1,40,000.

**FAST TURQ BLUE RBL:** To Keelung: Sanjay Sales Corp., 4,000 Kgs., Rs. 2,22,949.

**PHTHALO CYANINE BLUE 2661:** To New York: Sudershan Chemical Indus., 1,000 Kgs., Rs. 1,66,382.

**PHTHALO CYANINE GREEN 2724:** To New York: Sudarshan Chemical Indus., 2,000 Kgs., Rs. 4,01,106.

**REACTIVE BLACK B:** To Genoa: Metro Chem Inds., 6,000 Kgs., Rs. 5,31,217.

**SYN COALTAR DYES:** To Genoa: Golden Dyes Corp., 800 Kgs., Rs. 1,19,700; To New York: Venu Intl., 1,015 Kgs., Rs. 1,48,787.

#### **DRUGS MATERIALS EXPORTED BOMBAY (5.3.90)**

**AMPICILLIN TRIHYDRATE BP:** To Penag: Ranbaxy Labs Ltd., 600 Kgs., Rs. 6,10,944.

**CHLORPHENIRAMINE MALEATE BP:** To Hamburg: Venkatram Chem Ltd., 500 Kgs., Rs. 3,03,156.

**CHLORPHENIRAMINE MALEATE BP 88%:** To Penang: Meht Pharm Inds., 100 Kgs., Rs. 63,000.

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CHLORPHENIRAMINE MALEATE BP 80: To Singapore: Metha harms. Lts., 300 Kgs., Rs. 1,93,000.

DRUG INTERMEDIATES: To Bangkok: United Chemicals, 7,000 Kgs., Rs. 1,86,162.

**MATERIALS EXPORTED  
BOMBAY  
(From 2.3.90 To 9.3.90)**

ALEURTIC ACID: To New York: Khla Chemicals Ltd., 1,000 Kgs., Rs. 5,20,660

META AMINO PHENOL: To Singapore: HOC Ltd., 2,000 Kgs., Rs. 3,50,911.

4, 4 DIAMINO STILBENE 2, 2 DISULPHONIC ACID: To Charleston: Vasant Chemicals P. Ltd., 10,536 Kgs., Rs. 10,97,620.

2, 5 DICHLORO ANILINE: To New York: Sandoz (I) Ltd., 2,000 Kgs., Rs. 1,17,958.

2, 5 DICHLORO SULPHANILIC ACID: Aarti Organics P. Ltd., 1,000 Kgs., Rs. 84,000.

DIPHENHYDRAMINE HYDROCHLORIDE USA: To New York: Unichem Labs Ltd., 800 Kgs., Rs. 2,00,000.

FERROUS FUMARATE: To Port Keelung: Associated Chem Pharma P. Ltd., 4,050 Kgs., Rs. 1,39,957.

G SALT: To New York: Vivid Exports, 4, 400 Kgs., Rs. 1,62,257.

GAMMA ACID: To New York: Mardia Chemicals Ltd., 15,750 Kgs., Rs. 19,06,383.

H ACID: To New York: Mardia Chemicals Ltd., 31,500 Kgs., Rs. 23,98,298; To Bangkok: Vision Intermediates (I) Ltd., 12,963 Kgs., Rs. 10,05,957; To Keelung: Vivid Exports, 8,141 Kgs., Rs. 5,29,034.

K ACID: To Keelung: Colori Intl., 4,601 Kgs., Rs. 3,11,489; To Kobe:

Metro Chem Inds., 7,629 Kgs., Rs. 5,67,183.

LAB CHEMICALS: To Keelung: Champa Purie Chem Inds., 736 Kgs., Rs. 39,000.

MALEIC ANHYDRIDE: To Singapore: Adarsh Chemicals & Fertilisers, 17,500 Kgs., Rs. 2,64,255.

METANILIC ACID: To Osaka: Arlabs Ltd., 7,000 Kgs., Rs. 4,20,000.

2 NAPHTHYLAMINE 1, 5 DISULPHONIC ACID: To Keelung: Vivid Exports, 2,689 Kgs., Rs. 1,78,270.

2 NAPHTHYLAMINE: To Keelung: Vivid Exports, 3,067 Kgs., Rs. 2,01,686.

NICOTINE SULPHATE: To Yokohama: Unitrust Nicotine Inds., 14,850 Kgs., Rs. 9,40,000; Urvating, 20,025 Kgs., Rs. 1,16,500.

META NITRO BENZENE SULPHONIC ACID SODIUM SALT: To Kobe: Jaspen Intl., 16,000 Kgs., Rs. 3,81,574.

PENTAERYTHRITOL TECH: To Bangkok: Aegis Chemical Inds., 20 Mts., Rs. 3,13,000.

1, 3 PHENYLENE DIAMINE: To Keelung: Vivid Exports, 1,923 Kgs., Rs. 2,17,601.

R SALT: To New York: Vivid Exports, 2,275 Kgs., Rs. 1,08,472.

RED PHOSPHOROUS: To P. Elizabeth: United Phosphorous Ltd., 11,440 Kgs., Rs. 6,01,000.

SODIUM PENTACHLORO PHENATE: To Singapore: Chika Ltd., 15,000 Kgs., Rs. 4,43,064.

SODIUM SULPHATE 99%: To Bangkok: Grasim Inds., Ltd., 289 Mts., Rs. 5,73,848.

SULPHO TOBIAS ACID: To New York: Vivid Exports, 3,360 Kgs., Rs. 2,10,316.

META UREIDO ANILINE: To Bangkok: Liberty Exports Ltd., 2,271 Kgs., Rs. 1,87,234.



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VINYL SULPHONE ACETANILIDE: To Kobe: Sunbeam Monochem P. Ltd., 3,150 Kgs., Rs. 2,61,226.

VINYL SULPHONE ACETANILIDE BASE: To New York: Sagar Drugs & Pharma, 18,100 Kgs., Rs. 15,47,387.

ZINC OXIDE: To Singapore: Metazinc India Ltd., 18,000 Kgs., Rs. 3,69,362.

### DRUGS MATERIALS EXPORTED BOMBAY (From 2.3.90 To 9.3.90)

BULK DRUGS: To Toronto: Jai Inds., 2,000 Kgs., Rs. 83,915.

CLOXACILLIN SODIUM BP: To Keelung: Armour Chemicals Ltd., 25 Kgs., Rs. 31,404; To Penang: Kopran Chemical Co. Ltd., 200 Kgs., Rs. 2,30,300.

DRUG INTERMEDIATES: To Kobe: Sameraj, 10,000 Kgs., Rs. 2,56,410.

ERYTHROMYCIN STEARATE BP: To Keelung: Armour Chemicals Ltd., 100 Kgs., Rs. 92,000.

ETHAMBUTOL HCL BP: To Busan: Lupin Labs Ltd., 400 Kgs., Rs. 2,52,000.

IBUOFEN POWDER BP 80: To Busan: Euresian, 1,000 Kgs., Rs. 2,28,834.

SULPHAMETHOXAZOLE: To Hong Kong: Std Organics Ltd., 10,000 Kgs., Rs. 21,00,000.

SULPHAMETHOXAZOLE BP 88: To Bangkok: Siris Ltd., 6,000 Kgs., Rs. 14,70,000.

SULPHAMETHOXAZOLE BP/USP: To New York: Std Organics Ltd., 5,000 Kgs., Rs. 12,20,000.

### MATERIALS IMPORTED BOMBAY (FROM 18.5.90 To 21.5.90)

ACETYLENE BLACK: From Sin-

gapore: Lakhanpal National Ltd., 36 Mts., Rs. 10,52,319.

ACRYLAMIDE: From Japan: Indian Dyes & Chemicals, 1,000 Kgs., Rs. 26,177.

DL-2 AMINO-1-BUTANOL: From FRG: Cadila Labs. Ltd., 15,210 Kgs., Rs. 24,56,116.

AMMONIA ANHYDROUS: From Saudi Arabia: RCF., 4499.559 Mts., Rs. 1,04,07,678.

ACETOPHENONE: From FRG: S.D. Fine Chem Ltd., 5,000 Kgs., Rs. 1,11,827.

ACRYLAMIDE: From Japan: Arajot Chemicals P. Ltd., 5,000 Kgs., Rs. 1,30,886.

ACRYLIC ACID: From Japan: Jal Ltd., 4,000 Kgs., Rs. 1,25,271.

AEROSIL: From Belgium: E. Merck (India) Ltd., 860 Kgs., Rs. 2,26,907.

ALUMINIUM HYDRIDE: From

USA: Cipla Ltd., 997.5 Kgs., Rs. 1,52,318.

2-AMINO THIOPHENOL: From Switzerland: Cheminor Drugs Ltd., 3,632 Kgs., Rs. 12,13,794.

ANILINE OIL: From UK: Jaysyn Dye Chem Ltd., 18,000 Kgs., Rs. 3,60,106.

AROMATIC CHEMICALS: From Taiwan: Arochem Inds., 400 Kgs., Rs. 65,328.

BROMO CHLORO PROPANE: From FRG: Hoechst India Ltd., 5,500 Kgs., Rs. 4,91,479.

BUTACHLOR TECH: From Taiwan: Crop Health Products Ltd., 15.6 Mts., Rs. 6,44,755.

BUTACHLOR TECH 94%: From USA: Northern Minerals Ltd., 69,840 lbs., Rs. 13,80,906; Omega Agro P. Ltd., 69,840 Lbs., Rs. 13,80,906.

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UTYL ACRYLATE: From Japan: Ichi Karkaria Ltd., 2,880 Kgs., Rs. 86,358.

4 BUTYLIDINE BIS: From USA: Century Enka Ltd., 3,017 Kgs., Rs. 8,09,453.

CALCIUM CARBONATE: From Glaxo India Ltd., 5,000 Kgs., Rs. 88,535.

D-CAMPHOR SULPHONIC ACID: From France: Wockhardt Ltd., 1,000 Kgs., Rs. 4,18,834.

CAPROLACTAM: From Belgium: Arware Nylons Ltd., 1,24,250 Kgs., Rs. 36,86,172; From Netherlands: Petrolfilms Co-op. Ltd., 32,480 Kgs., Rs. 8,95,946.

CARBON ACTIVATED: From Japan: Pfizer Ltd., 15 Mts., Rs. 92,276.

ORTHO CHLORO BENZALDEHYDE: From Japan: Ranbaxy Labs. Ltd., 5,060 Kgs., Rs. 4,41,521.

4-CHLORO-3, 5 DINITRO BENZOTRIFLUORIDE: From Italy: BASF India Ltd., 20,100 Kgs., Rs. 13,32,938.

CITRIC ACID ANHYDROUS: From China: FDC Ltd., 16.95 Mts., Rs. 3,40,171.

CITRIC ACID: From China: T.G. Silk & Synthetic, 20 Mts., Rs. 2,92,942.

COBALT OXIDE BLACK: From Japan: Indu Nissan Oxo Chemicals, 1,200 Kgs., Rs. 11,48,112.

COPPER NITRATE: From FRG: Century Enka Ltd., 1,50 Kgs., Rs. 88,588.

CYCLOHEXYL MERCAPTAN: From Netherlands: PIL., 21,300 Kgs., Rs. 9,59,388.

CYSTEAMINE HCL: From Japan: Glaxo India Ltd., 3,000 Kgs., Rs. 5,20,052.

DESMODUR: From FRG: Bombay Paints & Allied Products, 42.54 Kgs., Rs. 70,542.

DICETYL PEROXYDICARBONATE: From Sweden: Shriram Vinyl & Chemical Inds., 6,000 Kgs., Rs. 11,57,988.

DICHLORONITRO BENZENE: From Japan: Indian Extractions Ltd., 18,000 Kgs., Rs. 8,19,409.

3, 4 DICHLORONITROBENZENE: From UK: Sudarshan Chemical Inds., Ltd., 7,200 Kgs., Rs. 3,61,391.

DIETHYL DICHLORO SILANE: From FRG: Cadila Labs. Ltd., 3,000 Kgs., Rs. 1,41,817.

1, 4 DIOXANE: From Japan: Std Inds., Ltd., 12 Mts., Rs. 3,97,892.

TERT. DODECYL MERCAPTAN: From FRG: Asian Paints India Ltd., 1,155 Kgs., Rs. 58,239.

EPICHLOROHYDRINE: From Japan: Jadavji & Co., 6,000 Kgs., Rs. 1,46,592; Sandoz (India) Ltd., 15,840 Kgs., Rs. 3,87,002.

ETHOXY METHYLENE DIETHYL MALONATE: From France: E. Merck (India) Ltd., 9,000 Kgs., Rs. 19,78,989.

N-ETHYL-N-CYANO ETHYL ANILINE: From UK: Sandoz India Ltd., 8,800 Kgs., Rs. 3,76,950.

2-ETHYL HEXANOIC ACID: From FRG: Decna Paints Ltd., 14,060 Kgs., Rs. 2,76,282.

GAMMA FERRIC OXIDE: From USA: Letape India Pvt. Ltd., 5,000 Kgs., Rs. 1,26,522.

FORMAMIDE: From Japan: Hindustan Antibiotics Ltd., 16.06 Mts., Rs. 4,06,624.

GUM ROSIN: From China: Aroon Mills, 9 Mts., Rs. 79,318; From Indonesia: JBA Printing Inks Ltd., 18 Mts., Rs. 58,633.

IODINE CRUDE: From Japan: Gayatri Labs. Pvt. Ltd., 1,000 Kgs., Rs. 2,80,968.

ISOBUTYL BENZENE: From USA: Sekhsaria Chem. P. Ltd., 13.657 Kgs.,

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Sodium as $\text{Na}_2\text{O}$	:	Negligible
Titanium as $\text{TiO}_2$	:	Negligible
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House No. 1024, 10th Main Road,  
West of Chord Road, IIIrd Stage, 1st Block,  
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## ***Citric Acid from Citurgia. The name that spells international quality.***

The name Citurgia is today synonymous with Citric Acid of the finest quality.

Citurgia caters to more than just one need in more than just one industry. Besides the traditional usage of Citric Acid in food, soft drinks, confectionery and drugs, today the uses of Citric Acid extend to new areas:

\* In the textile printing and dyeing industry it provides 'STABLE pH' conditions for polyester and nylon. As also for acrylic prints curing and cotton-resist printing. Citric Acid has successfully replaced imported Tartaric Acid because of its excellent quality, low costs and easy availability. Also, it is a very

safe acid compared to other organic and inorganic acid salts.

- \* Citric Acid prevents flavour deterioration, rancidity and discoloration in edible oils.
- \* It imparts an acidic taste to dry powdered drinks.
- \* It is also used as a descaling solution.

Citurgia Biochemicals Ltd. is the largest producer of high quality Citric Acid in India. Besides catering to the domestic demand, Citurgia's Citric Acid is exported to USA, Japan, Germany, Australia, Iran, Malaysia, Sri Lanka and other countries.



## **Citurgia Citric Acid-India's No. 1**

### **CITURGIA BIOCHEMICALS LIMITED**

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